Errata

A Field Guide for Site Identification and Interpretation for the Nelson Forest Region - Land Management Handbook 20

page iii	Andy McKinnon should read "Andy MacKinnon"; Tracy Flemming should read "Tracy Fleming".
page 31	The upper St. Mary River valley should be Interior Cedar - Hemlock not a lake.
page 33	ICHxw tree species column should not include Bl. ICHdw tree species column should have Ac, (Bl) in with the nonbold species, (i.e., they are not zonal climax species).
page 75	02 Antelope-brush - bluebunch wheatgrass , 03 Fd - snowberry - balsamroot, 05 SxwAt - sarsaparilla, 06 Scrub birch - horsetail and 07 Sxw - horsetail decision boxes should state "usually calcareous".
page 83	02 Saskatoon - bluebunch wheatgrass decision box should read usually noncalcareous". 03 Pl - juniper - pinegrass and 06 Sxw - dogwood - horsetail decision boxes should read "usually calcareous".
page 86	Other prescription considerations for 03 site series should read "seed banking species may be prolific after fire".
page 107	03 Bl - azalea - grouseberry decision box should read "usually noncalcareous". 04 Bl - azalea - soopolallie and 02 Fd - Douglas maple - soopolallie decision boxes should read "usually calcareous".
page 110	Other prescription considerations for 02 site series should read "seed banking species may be prolific after fire".
page 123	Distinguishing the ICHmk1 from ICHxw1 omitted; please refer to page 130 for this comparison.
page 124	Soopolallie is listed twice. Please disregard the second occurrence.
page 129	Common site sensitivities for site series 05 should read "High compaction hazard".
page 136	Other prescription considerations for 04 site series should read "seed banking species may be prolific after fire".
page 144	Other prescription considerations for 03 site series should read "seed banking species may be prolific after fire".
page 150	*Dryopteris assimilis* should be *D. expansa*.
page 253	Site series 04 should include Pl as an acceptable species.
page 273	The following conversions from old to new site series were omitted:

ESSFb/02	=	ESSFwc1/02, ESSFwc4/02
ESSFb/03	=	ESSFwc1/01, ESSFwc4/04,01
ESSFb/01	=	ESSFwc1/01, ESSFwc4/01
ESSFb/04	=	ESSFwc1/03, ESSFwc4/05
ESSFb/05	=	ESSFwc1/04, ESSFwc4/06
ESSFb/06	=	ESSFwc1/05, ESSFwc4/07
ESSFb/07	=	ESSFwc1/05, ESSFwc4/08
ICHc2/02	=	MSdk/02
ICHc2/03	=	MSdk/03
ICHc2/04	=	MSdk/04
ICHc2/01	=	MSdk/01
ICHc2/05	=	MSdk/01,05
ICHc2/06	=	MSdk/06
ICHc2/07	=	MSdk/06
ICHc2/08	=	MSdk/07
ICHc2/09	=	MSdk/07

page 276	Cooper, S.V. ... should read "Cooper,S.V., K.E. Neiman, R. Steele, and D.W. Roberts. 1987. Forest habitat types of northern Idaho: a second approximation. U.S. Dep. Agric. For. Serv., Intermtn. For. Range Exp. Stn., Ogden, Utah. Gen. Tech. Rep. INT-236"

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A Field Guide for Site Identification and Interpretation for the Nelson Forest Region

Compiled and Edited
by
T.F. Braumandl and M.P. Curran

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518 Lake Street
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1 INTRODUCTION

by

T.F. Braumandl and M.P Curran

1.1 Objectives and Scope

This guide presents site identification and interpretation information for forest and range ecosystems of the Nelson Forest Region (Figure 1.1).

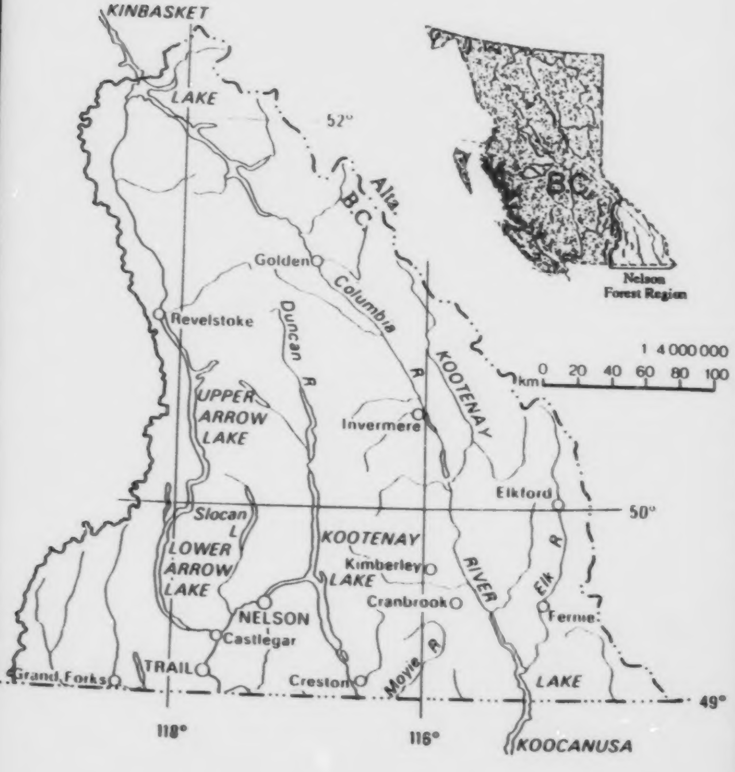
KINBASKET
LAKE
52°
Alta.
B.C.
B.C.
Nelson Forest Region
Golden
Columbia
R
Revelstoke
Duncan
R
KOOTENAY
1 4 000 000
km 0 20 40 60 80 100
UPPER ARROW LAKE
Invermere
Elkford
50°
Slocan L
LOWER ARROW LAKE
KOOTENAY LAKE
Kimberley
Cranbrook
RIVER
Elk R
Fernie
NELSON
Castlegar
TRAIL
Grand Forks
Creston
Moyie R
LAKE
49°
118°
116°
KOOCANUSA

FIGURE 1.1. Map of the Nelson Forest Region.

The Nelson Forest Region encompasses most of southeastern British Columbia. It comprises about 8 million ha, of which about 1/2 is forest land. The region is dissected by several north/south trending mountain ranges: the Monashees, Selkirks, Purcells, and Rockies. A wide variety of climatic regimes is a result of these mountain ranges and the prevailing westerly winds. The geology and soils of the region are also diverse. The resultant vegetation ranges from grassland, to interior rainforest, to alpine tundra. This guide organizes some of this variation into a classification system.

The classification system used follows the Biogeoclimatic Ecosystem Classification (BEC) developed for the province by the British Columbia Ministry of Forests (Pojar *et al.* 1987). The principles, evolved from V.J. Krajina (1965, 1969), are described in Chapter 2. The objectives of this classification are:

- to provide a framework for organizing ecological information and management experience about ecosystems;
- to promote further understanding of identified ecosystems and the relationships between them;
- to supply resource managers with a common language to describe forest sites; and
- to improve the user's ability to prescribe and monitor treatment regimes on a site-specific (ecosystem) basis.

This guide has two main goals:

- to assist the user in classifying sample sites in the field; and
- to provide interpretations for these sites that assist the user in preparing management prescriptions.

This guide replaces the *Field Guide to the Identification and Interpretation of Ecosystems of the Nelson Forest Region* (Utzig *et al.* 1986). This version results from the recent completion of an inter-regional correlation of the BEC system, which has helped to ensure the consistency and quality of the ecological information base across the province. Data from both the Kamloops and Nelson Forest Regions were used for analysis of similar shared areas. Appendix 2 presents the correlation between the 1986 ecosystem and biogeoclimatic units and this classification.

All sites slated for harvest are required by law, under the Silviculture Regulations (1988), to be classified according to the biogeoclimatic classification system.

1.2 Other Sources of Information

Numerous reports on vegetation and ecosystem description and classification exist for the Nelson Forest Region and adjoining areas. These include National Park ecological land classification reports, habitat type reports for neighboring states, and British Columbia Ministry of Environment wildlife habitat reports and mapping. A list of these publications and maps can be found in Appendix 3.

More complete descriptions of biogeoclimatic and site units at broader levels, particularly site associations and groups, will be available in a series of biogeoclimatic zone reports to be published soon by the B.C. Ministry of

Forests, Research Branch. Information at the biogeoclimatic zone level is available in *Ecosystems of British Columbia* (Meidinger and Pojar 1991).

References for plant identification guides are provided in Appendix 4.

1.3 Guide Contents and Limitations

This guide consists of seven chapters. Following this introduction is a description of the classification system (Chapter 2). Chapter 3 outlines procedures for site description, identification, mapping, and interpretation; Chapter 4 contains general descriptions of the zones of the Nelson Forest Region; and Chapter 5 provides tools for identifying biogeoclimatic and site units and provides general management interpretations for the identified site series. Chapter 6 provides wildlife interpretations and Chapter 7 presents forest health concerns. A number of appendices are included to provide specific interpretations such as silivicultural standards and forage seeding mixes or technical information such as plant species lists and soil/site description keys.

Maps for the Nelson Region biogeoclimatic subzones and variants (1:250 000 scale) are available in each district or from the ecologist or pedologist, Nelson Forest Region.

The classification is based on a total of 1288 plots located in the Nelson Region, as well as additional plots located in the Kamloops and Prince George Regions. Sample plots are generally well-distributed geographically (proportional to the size of the subzone) with the exception of some of the higher elevation subzones/variants (ESSFdk, ESSFwm, ESSFdc1, ESSFwc1, ESSFwc4, all parkland subzones, and Alpine Tundra). Poor access curtailed data collection in these units. Some less common sites (e.g., very dry and wet sites) were often characterized by only a few plots.

Regarding management interpretations, this field guide is designed to complement, not replace, other more detailed prescription guides, including *Site Preparation Strategies to Manage Soil Disturbance* (Curran *et al.* 1990); *Standard Operating Procedures*: Armillaria ostoyae, B.C. Ministry of Forests, Forest Health Section, Nelson B.C.; and *Preharvest Silviculture Prescription Procedures and Guidelines for the Nelson Forest Region*, B.C. Ministry of Forests, Silviculture Section, Nelson B.C.

1.4 Training Courses

It is assumed that the user of this guide has completed the BEC training programs offered by the Regional Forest Sciences Section, and that the basic concepts and methods of site, soil, and vegetation evaluation have been mastered. These courses are offered annually at various locations within the region. As well, pre-harvest silviculture prescription (PHSP) and silviculture survey courses that have an ecological classification component are held annually. For information about such training courses, please contact the ecologist or pedologist, Nelson Forest Region.

2 THE BIOGEOCLIMATIC ECOSYSTEM CLASSIFICATION (BEC) SYSTEM

by

T. F. Braumandl, M. P. Curran, and D. L. DeLong

This section briefly describes the biogeoclimatic classification system. For a more complete description please refer to *Ecosystems of British Columbia* (Meidinger and Pojar 1991) or *Biogeoclimatic Ecosystem Classification in British Columbia* (Pojar *et al.* 1987).

2.1 Classification System

The BEC system is a hierarchical classification scheme that combines three classifications: climatic (or zonal), vegetation, and site. For practical purposes, users need be concerned only with the zonal and site classifications (Figure 2.1). The information presented in this guide will allow the user to apply BEC in the field.

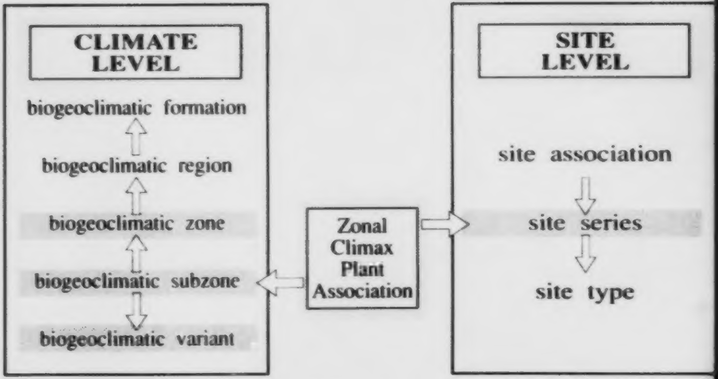
CLIMATE LEVEL
biogeoclimatic formation
biogeoclimatic region
biogeoclimatic zone
biogeoclimatic subzone
biogeoclimatic variant
Zonal Climax Plant Association
SITE LEVEL
site association
site series
site type

FIGURE 2.1. Hierarchical relationship between climatic level (zonal) and site level classifications. (Taken from Pojar *et al.* 1987). The highlighted levels are described in this guide.

2.2 Zonal (Climatic) Classification

Biogeoclimatic units are the result of zonal (climatic) classification, and they represent groups of ecosystems under the influence of the same regional climate. There is a hierarchy of these climatic units, with the biogeoclimatic *subzone* being the basic unit. Subzones are grouped into *zones*, and divided into *variants*. Data from long- and short-term climate stations have been used to help characterize subzones.

Because the climate stations are not well distributed within and between subzones, climax vegetation on zonal sites is used as an indicator of the long-term climate of an area. Each **biogeoclimatic subzone** has a distinct climax (or near-climax) plant association on zonal sites. **Zonal sites** have deep, loamy soils, and occupy midslope positions with mesic moisture regimes. The zonal climax vegetation is thought to best reflect the regional climatic conditions of the subzone.

Ecosystems within a subzone are influenced by one type of regional climate. Edaphic (soil) and topographic conditions influence the climax vegetation of sites drier or wetter than the zonal condition. Thus, subzones have distinctive sequences of related ecosystems, ranging from dry to wet sites. For example, in a moist, warm subzone, zonal sites are dominated by western redcedar and western hemlock with feathermosses dominating the understory; while dry sites have Douglas-fir stands with shrubby understories of falsebox, saskatoon, and Utah honeysuckle. Wet sites in the same subzone (climate) have redcedar, hemlock, and spruce overstories with devil's club and lady fern beneath.

The **biogeoclimatic variant** was defined because subzones contain considerable geographic variation. Variants reflect further differences in regional climate and are generally recognized for areas that are slightly drier, wetter, snowier, warmer, or colder than other areas in the subzone. For example, the Golden Moist Warm Interior Cedar - Hemlock variant is cooler and more continental than the Columbia-Shuswap Moist Warm Interior Cedar - Hemlock variant. These climatic differences result in changes in vegetation, soil, and ecosystem productivity. The differences in vegetation are evident as distinct zonal climax plant subassociations. These may be changes in the occurrence of certain plant species (often trees) or variations in successional development. For example, the Golden variant lacks western larch and has more knight's plume moss and false azalea compared to the Columbia - Shuswap variant.

Subzones with similar climate characteristics and zonal ecosystems are grouped into **biogeoclimatic zones**. A zone is a large geographic area with a broadly similar type of climate. A zone has typical patterns of vegetation and associated similarities in nutrient cycling and soil climate. Zones also have one or more typical zonal climax species of tree, shrub, herb, and/or moss.

Zones are usually named after one or more of the dominant climax species in their zonal ecosystems and may include a geographic or climatic modifier (e.g., Interior Cedar - Hemlock zone). Zones are given a two- to four-letter code, corresponding to the name (e.g., the Interior Cedar - Hemlock zone code is ICH).

Subzone names are derived from classes of relative precipitation and temperature. Subzone codes correspond to climatic modifiers (Table 2.1) Variants are named by a geographic area and coded by a number. For example, ICHmw2 refers to the Columbia-Shuswap (2) variant, of the Moist Warm (mw) subzone, of the Interior Cedar - Hemlock (ICH) zone.

TABLE 2.1. System of naming and coding Interior biogeoclimatic subzones

ZONE ***ab***

***a* = precipitation regime**	***b* = temperature regime**
x = very dry (xeric)	h = hot
d = dry	w = warm
m = moist	m = mild
w = wet	k = cool
v = very wet	c = cold
	v = very cold

Precipitation and temperature regimes are all relative within the biogeoclimatic zone.

2.3 Site Series Classification[1]

The **site series** classification groups ecosystems within a subzone or variant that have similar environmental properties, and vegetation that will occur in late seral or climax stages. Potential vegetation of a group of sites is used with selected accessory environmental properties to characterize site series.

Subzones or variants have a characteristic sequence of site series according to soil moisture regime[2] (SMR) and, to a lesser degree, soil nutrient regime[3] (SNR). An example of how a site series sequence may occur on the landscape is presented in Figure 2.2.

Soil moisture regime is a relative scale of "available water" for plant growth within the subzone/variant climate. An eight-class scale is used and ranges from 0 or very xeric (bare rock) to 7 or subhydric (water at or near the surface year round). **Soil nutrient regime** is a relative scale of "available nutrients" for plant growth. A five-class scale is used and ranges from A (very poor) to E (very rich).

Common names of one to four species are used to name site series, and tree species codes are usually substituted to shorten the name (e.g., HwCw[4] - Falsebox - Feathermoss site series).

Similar plant communities can occur in different subzones, but under different moisture regimes. These belong to the same grouping of site series (site association)[5]. Each site series is given a two-digit numeric code, related to its position on the relative moisture and nutrient scales. For example:

ICHmw1/HwCw - Falsebox - Feathermoss site series = ICHmw1/01
ICHwk1/HwCw - Falsebox - Feathermoss site series = ICHwk1/04
ICHvk1/HwCw - Falsebox - Feathermoss site series = ICHvk1/03

---

[1] Site series were formerly known as ecosystem associations.

[2] Appendix 4 contains a soil moisture regime identification key.

[3] Appendix 5 contains a soil nutrient regime identification table.

[4] Tree species codes follow British Columbia Ministry of Forests standards and are found in Appendix 13.

[5] Site associations are not used in the classification presented in this manual. They are defined in Pojar *et al.* (1987).

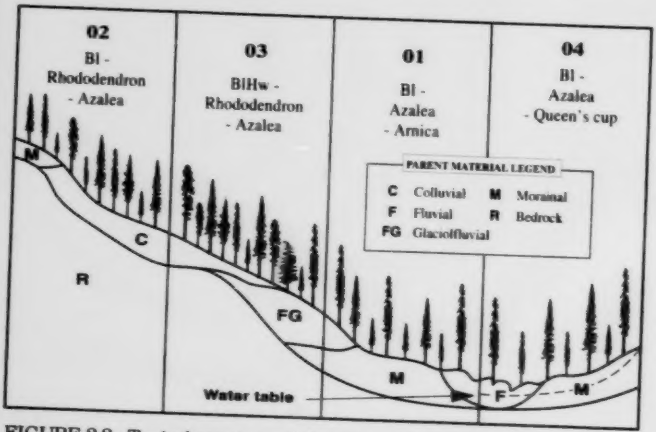
02
Bl - Rhododendron - Azalea
03
BlHw - Rhododendron - Azalea
01
Bl - Azalea - Arnica
04
Bl - Azalea - Queen's cup
PARENT MATERIAL LEGEND
C Colluvial
M Morainal
F Fluvial
R Bedrock
FG Glaciofluvial
M
C
R
FG
M
Water table
F
M

FIGURE 2.2. Typical sequence of site series in the ESSFwm.

All three of these site series belong to the same site association, so their climax vegetation is similar, but their site conditions and seral vegetation patterns differ.

Within a subzone/variant, the 01 site series is the zonal or mesic site, with the rest ranked from driest (02) to wettest (e.g., 07). If distinction is made on the basis of nutrient regime, the richer site series is numbered higher.

Often the site series is the basis for the treatment unit[6] for which silvicultural and other management decisions are made. In some cases, however, the site series is best divided into more operationally significant units; e.g., based on soil texture or soil moisture regime. This is especially true of widespread site series that encompass a range of site conditions. The fact that site series may be found with a wide range of soil and site characteristics can be explained by compensating factors (see Section 3.4.6).

The **site series phase** is used for better distinguishing sites for management purposes. It is not a formal unit in the classification, but it can be used to subdivide site series. For example, in the Dry Warm Interior Cedar - Hemlock variant (ICHdw), the **CwFd - Falsebox site series** is found on a wide range of moisture regimes. Recognizing two phases allows more precise management interpretation of this site series even though the vegetation is very similar. In other cases, site series phases could be based on slope classes, aspect, parent materials, soil climate, or bedrock geology. Recognizing any change in such characteristics can be important because they influence an ecosystem's response to external disturbances. Use of the phase also allows more consistent prediction of ecosystem response to management treatments.

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[6] Treatment units are briefly described in Section 3.5.

A phase is named according to its differentiating criteria, and is given an alphabetical code. For example, ICHdw/01*a* is the code for the drier phase of the ICHdw/01 site series. Four site series phases are presented in this manual.

3 PROCEDURES FOR SITE DESCRIPTION, IDENTIFICATION AND INTERPRETATION

by

M.P. Curran, T.F. Braumandl, D.L. DeLong, and G.D. Davis

3.1 Introduction

Ecological site identification consists of comparing field characteristics with information presented in this guide. Several tools are included in this guide to help identify subzones/variants and site series. These include maps (available separately), summary tables of vegetation and site characteristics, site series identification flowcharts, edatopic grids, and subzone/variant descriptions. This chapter is designed as a reference when using the subzone and site series identification tools contained in Chapters 4 and 5.

As experience in identifying ecosystems is gained, one becomes less reliant on these tools; however, site conditions must still be reviewed thoroughly. It is important to realize that there is much more natural variability in the forests than is portrayed in this field guide; thus, not every ecosystem encountered will be easily "pigeon-holed" into an existing classification unit. The "cookbook" approach to site identification and interpretation is discouraged; an appreciation of the complexity and interconnectedness of forest ecosystems is hopefully fostered.

Ecosystem identification is not an end in itself. The vegetation, soils, and environment data collected to identify a site unit have a wide variety of uses. For example, the site information can be applied directly to PHSPs, regeneration surveys, site sensitivity evaluation, site degradation surveys, and wildlife habitat studies. With such wide application it is very important that *accurate* site information be collected; this is discussed in Section 3.3.

Once on-site information has been gathered, a site can then be identified. Chapter 5 provides the following subzone/variant and site series identification and interpretation tools:

- **Subzone/variant summary:** provides information on geographic location, climate, soils, geology[7], landforms, zonal vegetation, floristic criteria to distinguish adjoining subzones/variants, forest characteristics, and wildlife habitat.
- **Edatopic grid:** displays the arrangement of site series according to soil moisture and nutrient regimes.
- **Vegetation table:** shows common or diagnostic species of climax or late seral vegetation for each site series.

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[7] A key to the identification of common rocks of the Nelson Forest Region is presented in Appendix 11.

- **Landscape profile:** graphically represents an idealized sequence of ecosystems on the landscape, including the common tree species and dominant landforms of all site series for each subzone/variant.
- **Environment table:** outlines common soil moisture, aspect, slope, slope position, landform, soil texture, humus form, and important site features by site series.
- **Site series identification flowchart:** describes soil moisture regime, tree species, diagnostic vegetation, and environmental features of each site series in a decision flowchart format.
- **Management interpretation table:** outlines common growth limiting factors, relative forest productivity, vegetation potential and complexes, road drainage control needs, common site sensitivities and other prescription considerations by site series.

3.2 Identifying Subzones/Variants

Subzone/variant maps, elevation, tree species, and understory vegetation are used to determine subzones/variants. Tree species and elevation range for each subzone/variant are presented in Table 4.1 (Chapter 4). This table is also the map legend on each 1:250 000 map sheet[8] which must be used to locate the area in question and to identify the subzone/variant, or to determine if it is a transitional area near the boundary of two subzones/ variants.

The flowchart in Figure 3.1 describes how to identify subzone/variant. The 1:250 000 biogeoclimatic maps, the subzone/variant summary pages (described below), and the climate region vegetation tables (Tables 4.3, 4.4, 4.5) should be used. The climate region vegetation tables describe zonal vegetation to help distinguish adjoining subzones/variants. They are used in the same way as the subzone/variant vegetation tables (see Section 3.4.1).

If the user finds that the site is a potential transition between two subzones/variants, the climate region vegetation tables should be consulted again and both subzone/variant descriptions consulted in Chapter 5. If the site is still considered transitional after consulting both descriptions and the climate region vegetation tables, this must be noted. Prescriptions for these transitional areas should reflect the effect this transitional climate will have on growth limiting factors and other properties important to resource management.

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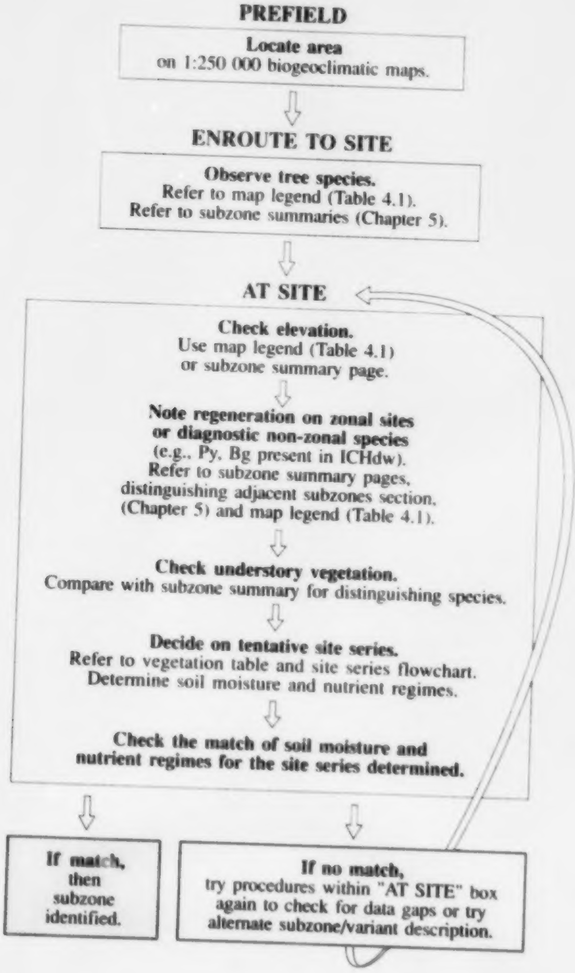
[8] 1:250 000 biogeoclimatic maps available from Regional Ecologist or Regional Pedologist.



PREFIELD

Locate area
on 1:250 000 biogeoclimatic maps.

ENROUTE TO SITE

Observe tree species.
Refer to map legend (Table 4.1).
Refer to subzone summaries (Chapter 5).

AT SITE

Check elevation.
Use map legend (Table 4.1)
or subzone summary page.

Note regeneration on zonal sites
or diagnostic non-zonal species
(e.g., Py, Bg present in ICHdw).
Refer to subzone summary pages,
distinguishing adjacent subzones section,
(Chapter 5) and map legend (Table 4.1).

Check understory vegetation.
Compare with subzone summary for distinguishing species.

Decide on tentative site series.
Refer to vegetation table and site series flowchart.
Determine soil moisture and nutrient regimes.

Check the match of soil moisture and
nutrient regimes for the site series determined.

If match,
then
subzone
identified.

If no match,
try procedures within "AT SITE" box
again to check for data gaps or try
alternate subzone/variant description.

FIGURE 3.1. Subzone/variant identification flowchart.

3.2.1 Subzone/variant summary page

The subzone/variant summary page for each subzone/variant in Chapter 5 describes the geographic location, elevation range, zonal vegetation, and distinguishing vegetation information to assist in subzone/variant identification, as outlined below:

- **Geographic location:** describes where the subzone/variant occurs and complements proper use of the 1:250 000 biogeoclimatic maps described above.
- **Elevation range:** lists the minimum and maximum elevations of that subzone/variant.
- **Zonal vegetation:** describes vegetation that is common on zonal sites. Zonal vegetation should be checked whenever possible to help verify the subzone/variant identification.
- **Distinguishing vegetation:** lists differences in widespread or diagnostic plant species relative to neighbouring subzones/variants. For example, for the MSdk, the distinguishing vegetation is describe for adjoining units, such as the ESSFdk; the example list below includes what the ESSFdk has or lacks *relative to* the MSdk, as follows:

"In the **ESSFdk:** most sites have:" - species listed occur on several site series, including zonal sites.

"zonal sites also have:" - species listed occur on zonal sites. Zonal sites will also have those species listed under most sites above.

"dry sites have:" - species listed occur on drier than zonal sites.

"wet sites have:" - species listed occur on wetter than zonal sites.

Within these site categories, species are also listed with abundance modifiers as follows:

(no modifier) - species present in the ESSFdk; absent in the MSdk.

"no" - absent in the ESSFdk; present in the MSdk.

"more" - found on more site series and/or with higher cover in the ESSFdk than in the MSdk.

"less" - found on fewer site series and/or with lower cover in the ESSFdk than in the MSdk.

The vegetation is listed in the sequence trees, shrubs, herbs, mosses, lichens, and liverworts.

The subzone/variant summary page also provides descriptive information on climate, soils, geology, landforms, forest characteristics, and wildlife habitat.

Climate: provides information on a *relative* rating of seasonal temperatures, precipitation, snowfall, and soil drying and freezing, as defined in Appendix 12. Besides its descriptive value, this information is useful in developing prescriptions for equipment operations on sites with high compaction hazards. Use of deep snowpacks or dry soils represent good strategies to minimize soil compaction when *local experience* confirms the presence of these general conditions. Regarding soil freezing, *bladed soils* are soils where the forest floor has been scalped through machinery blade construction of roads, landings, and skidroads; allowing newly constructed bladed surfaces to freeze before use minimizes compaction when use is restricted to frozen conditions. Major climatic limitations to tree growth and establishment are also presented in the description.

Soils, Geology, and Landforms: describes the common bedrock types, parent materials, and soil textures in the subzone/variant. This information comes from local geology, soil survey maps and reports, and the ecological sample plot data summarized in the *Environmental Tables* (Chapter 5). The bedrock geology helps identify possible limestone-derived (calcareous) materials or poor road building/slope stability rock types (e.g., phyllite, schists[9]). The parent materials description, along with the *Landscape Profile* (Chapter 5), helps the user become more familiar with the common parent materials and landforms. The soil texture information indicates common ranges sampled and helps identify problem textures presented in the *Management Interpretations Table* (Chapter 5) (e.g., clayey or silty soils with high compaction hazard).

Forest Characteristics: describes historical disturbance patterns (e.g., fire) and the general presence of seral stands and old growth in the subzone/variant.

Wildlife Habitat: describes wildlife values and important habitats in the subzone/variant. Habitat requirements of species at risk are emphasized.

3.3 Describing Site Series/Phases

Accurate descriptions of the site, soil, and vegetation features must be undertaken in the field for each ecosystem within a given management unit. A uniform, representative site of about 400 m^2 (20 x 20 m) should be chosen. Ecotone areas (such as slope breaks, landform boundaries, timber type boundaries, and road edges) should be avoided.

---

[9] A key to common rock types is presented in Appendix 11.

Depending on the scope and objectives of the survey, data can be collected on various field forms. At a minimum, the following information must be described if a site is to be correctly classified:

- tree species
- understory vegetation percent cover
- elevation (needed for subzone/variant confirmation)
- slope
- aspect
- slope position
- soil texture
- coarse fragment percentage
- landform
- depth to restricting layer or seepage
- humus form
- soil moisture regime
- soil nutrient regime (bedrock geology and calcareousness)[10]

The PHSP field form is the most widely used form for recording the data. Detailed instructions for completing these forms and collecting the above data are provided in Mitchell *et al.* (1991).

> **Caution:** It is strongly recommended that the user classify sample sites to site series before leaving the field, in case inconsistencies exist or more information is needed (e.g., soil moisture regime doesn't agree with vegetation due to compensating factors).

3.4 Identifying Site Series/Phases

Once site, soil, and vegetation information have been recorded for a given area, the next step is to identify and name the site series/phase. The flowchart in Figure 3.2 outlines how the tools for site identification can be used. A brief description of each of the tools follows.

It is important to note that species appearing in the site series name will occasionally be absent on the sample site. Site series where this is likely to occur have been identified by footnotes on the edatopic grid.

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[10] Calcareousness refers to degree of effervescence with 10% HCl. The fizz indicates free lime (calcium carbonate) from limestone-derived materials, resulting in high pH soils and nutritional problems for trees.

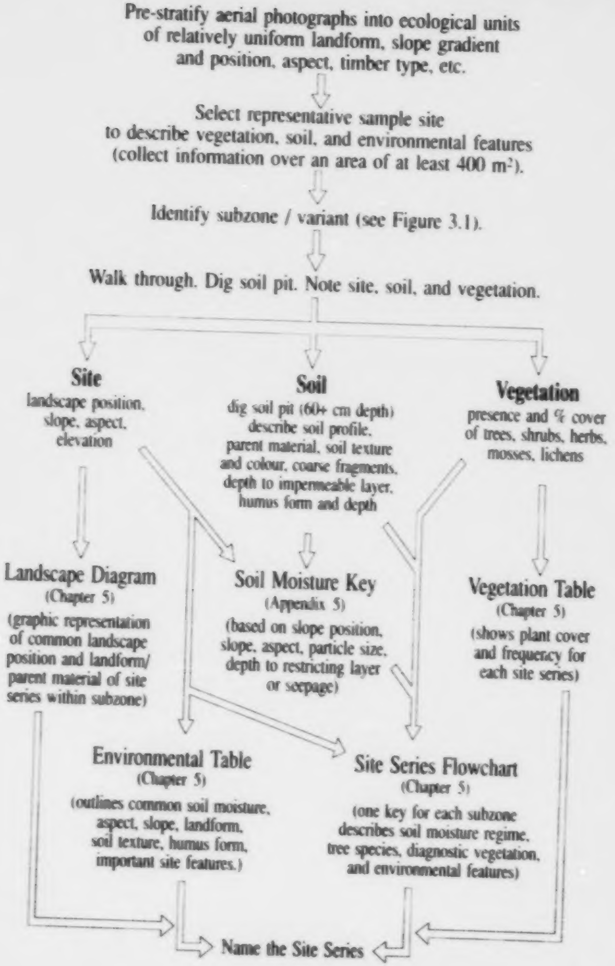

Pre-stratify aerial photographs into ecological units of relatively uniform landform, slope gradient and position, aspect, timber type, etc.
Select representative sample site to describe vegetation, soil, and environmental features (collect information over an area of at least 400 m²).
Identify subzone / variant (see Figure 3.1).
Walk through. Dig soil pit. Note site, soil, and vegetation.
Site
landscape position, slope, aspect, elevation
Soil
dig soil pit (60+ cm depth) describe soil profile, parent material, soil texture and colour, coarse fragments, depth to impermeable layer, humus form and depth
Vegetation
presence and % cover of trees, shrubs, herbs, mosses, lichens
Landscape Diagram
(Chapter 5)
(graphic representation of common landscape position and landform/ parent material of site series within subzone)
Soil Moisture Key
(Appendix 5)
(based on slope position, slope, aspect, particle size, depth to restricting layer or seepage)
Vegetation Table
(Chapter 5)
(shows plant cover and frequency for each site series)
Environmental Table
(Chapter 5)
(outlines common soil moisture, aspect, slope, landform, soil texture, humus form, important site features.)
Site Series Flowchart
(Chapter 5)
(one key for each subzone describes soil moisture regime, tree species, diagnostic vegetation, and environmental features)
Name the Site Series

FIGURE 3.2. Site series/phase identification flowchart.

3.4.1 Vegetation table

This table indicates the prominence of common or diagnostic species by site series for each subzone/variant. Prominence value (PV)[11] is a combined measure of plant species cover and constancy. Five prominence value classes are displayed by differently sized bars within the tables. (In the Kamloops Region field guide [Lloyd *et al.* 1990] only the top four classes are displayed in the vegetation tables.) The following rough guide gives the percent cover of a species within a particular site series:

▫ very low cover (<1%) or low constancy (<30%) with higher cover

▭ 1-7% cover or low constancy with higher cover

▭ 8-15% cover

▭ 16-25% cover

▭ >25% cover

These tables should be used as a general guide to the dominant and indicator species that best characterize each site unit. The actual abundance of plant species occurring on a particular site depends upon several factors, including the successional status of the site, and the type and degree of disturbance that initiated succession. These diagrams are derived from plots in mature forests (80 years or older).

When using the tables, we suggest "colouring-in" the boxes for the species present on the sample site. Colour grease pencils (e.g., "Omnichromes") work well. The boxes should be coloured-in based on the percent cover of the species, per the key on each vegetation table. The resulting pattern for each site series will be coloured boxes that are larger or smaller than the original box (i.e., species that are found with greater or lesser cover than predicted). The correct site series will have the largest proportion of coloured boxes that most closely resemble the original boxes (i.e., the largest proportion of species present with the expected cover). Plastic "Mac-Tac" pages are available for these tables to prolong their life and facilitate erasure.

By recording the actual percent cover on the field forms, a double check on your classification decision can be made later in the office or during audits.

3.4.2 Edatopic grid

The edatopic grids indicate how the site series relate to each other along the relative gradient of moisture regime and, to a lesser degree in the Nelson Forest Region, nutrient regime. Nutrient regime is more important in the case of a few site series that have been observed only on calcareous soils.

---

[11] PV = mean cover x square root of constancy within a site series. Constancy is a measurement of how often a species was found in a given site series.

3.4.3 Landscape profile

Landscape profiles are provided for each subzone/variant. These depict schematically the "typical" sequence of site series, tree species, and parent materials on an idealized slope. The landscape profile and the environment table are arranged so that the information for each site series is contained within the same column. An overall picture of the environmental setting of each site series is hopefully provided. The user should note that a given site series can occupy a wide range of landscape positions because of compensating factors (e.g., a particular site series may be found on upper slopes on a cool aspect or on lower slopes on a warm aspect - see Section 3.4.6). Thus, the actual sequence of site series may be different from that depicted and not all site series may be present in a given location.

3.4.4 Environment table

Tables summarizing the "common" environmental features associated with each site series are placed immediately below the landscape profile diagrams. Because of compensating factors (Section 3.4.6), a site series may have a wide range of conditions (such as soil texture) but the general trends are of value in helping the user recognize the "typical" site conditions and the resulting common site sensitivities and characteristics. The number of plots used to determine the environmental features of each site series is noted. Brackets denote less frequent occurrences. A brief description of each environmental feature is provided below:

Soil moisture regime (SMR) is the relative amount of soil moisture available for plant growth within the bounds of the subzone climate. A key for identification is found in Appendix 5. The number and letter codes for soil moisture regime are:

very xeric = 0, vx
xeric = 1, x
subxeric = 2, sx
submesic = 3, sm
mesic = 4, m
subhygric = 5, shg
hygric = 6, hg
subhydric = 7, shd

Aspect is a slope's orientation to the sun and it is measured with a compass. In this guide, aspect has been divided into the following classes:

SSE-W = warm
NW-ENE = cool

site series found on all or neutral aspects = variable

Slope gradient is the predominant range of slopes (extreme values removed). If the slopes range more than 50% amongst the sampled plots within a site series, "variable" is entered on the table.

Slope position or "mesoslope" position is the relative location of a site on the landscape. The scale considered is a vertical distance between 3 and 300 m and a surface area exceeding 0.5 ha in size (Luttmerding *et al.* 1990). Slope position ranges from crest to depression (Figure 3.3). Slope position may be abbreviated because of limited space on the environment table; for example, middle (mid.), lower (low.), upper (upp.), and depression (dep.).

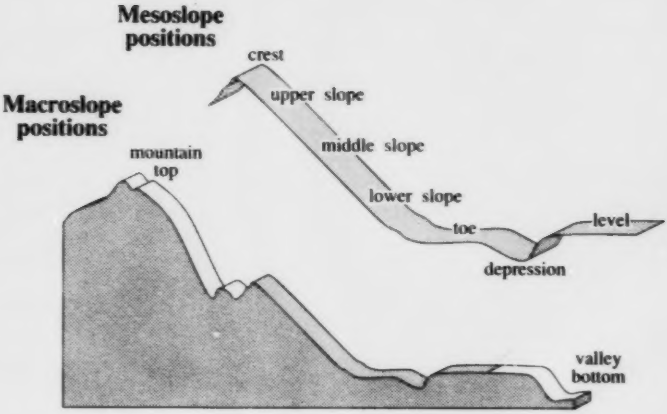

Mesoslope positions
Macroslope positions
crest
upper slope
middle slope
lower slope
toe
level
depression
mountain top
valley bottom

FIGURE 3.3. Slope position (mesoslope) (from Lloyd *et al.* 1990).

Parent materials provide the foundation from which soils develop. The landform codes are similar to the standard of Howes and Kenk (1988) with the exception of FG and R:

C = Colluvial
D = Saprolite (weathered bedrock)
E = Eolian
F = Fluvial
FG = Glaciofluvial
L = Glaciolacustrine
M = Morainal (Till)
O = Organic
R = Bedrock

A key to assist in the identification of landforms and parent materials is presented in Appendix 7.

Soil texture class and coarse fragment content are presented for two soil depths, the most sensitive (compactible) surface soil (to 30 cm depth) and the subsoil (30 cm+ depth). For both texture and coarse fragments, not all possible combinations of the presented data occur.

Soil texture is determined according to the relative amounts of sand, silt, and clay in the fine fraction of the soil (Appendix 8). In the table, the most common texture is presented first and the texture classes used are the same as the Ministry of Forests site sensitivity keys (e.g., Curran *et al.* 1990) as presented below:

L (Loamy) = L, SL
S (Sandy) = LS, S
$ (Silty) = Si, SiL
C (Clayey) = SiCL, CL, SCL, SiC, SC, C, HC

A hand-texturing key for field identification and the full names of the textural classes are presented in Appendix 8.

Coarse fragments for surface soil (to 30 cm depth) and subsoil (30 cm+ depth) are presented for each site series. Coarse fragments are all mineral particles >2 mm in diameter and their percentage (extreme values removed) is noted as follows:

(minimum - **mean** - maximum)
e.g., (5 - **25** - 40)

Humus forms, predominantly Mulls, Moders, and Mors, are presented along with the L, F, H horizon thickness in cm (minimum - **mean** - maximum, as with coarse fragments, above). Appendix 9 contains a key to field identification of humus forms.

Important site features identifies common features important to ecosystem function and management, such as the presence of restricting layers (for rooting or water movement), veneers of parent materials, and water table depth. Restricting layers include bedrock, compact glacial till, and dense soil horizons.

3.4.5 Site series identification flowchart

The flowcharts guide the user through a series of boxes containing vegetation and environment information for one or a group of units. In each case, a "yes" or "no" decision must be made based on field observations. After the user makes several choices, the site is ultimately "keyed-out" to the site series. The flowcharts include soil moisture regime, tree species, and diagnostic vegetation. It is important to start with the box titled "Start" and to read through the entire chart to ensure the best fit.

In summary, the user should be looking for the unit having the *best fit* of plant indicator species, site features, and soil features. *This does not mean that all the plant species or soil characteristics noted in the above tools will necessarily match those described in the field.* Compensating factors should be remembered. If there is not a reasonable fit at this stage, the description for the neighboring subzone/variant should be checked if the area is potentially transitional. Make a note and consult with the Regional Ecologist or Pedologist in unusual cases.

3.4.6 Ecological compensating factors

In ecosystems, one factor may compensate, or make up for, a deficiency in another. One example of this is how frequent fog can compensate for low precipitation by providing high humidities (resulting in low evaporation) and through moisture deposition onto foliage. Compensating factors must be considered in the practical application of the ecological classification presented in this manual.

In the application of the biogeoclimatic ecosystem classification system, the primary compensating factors that must be considered are soil and topographic properties as they influence soil moisture regime. A common example of this in the West Kootenay is a site series that is found on loamy textured soils in a mid-slope position, or on coarser-textured soils on lower slopes. Although the lower slope position would be expected to receive more seepage water input and have a wetter site series, the coarse soils compensate for this in a negative fashion by making the site drier than may be expected. This is because of the low water holding capacity of the coarser-textured soil. In the East Kootenay, the opposite is often true; site series may be found in higher slope positions than may be expected because of finer-textured soils making the moisture regime wetter than slope position alone would imply.

The *Environmental Tables* reflect the effect of compensating factors; for example, some site series are found on a wide range of soil textures. Compensating factors can also influence mesoclimate (for example, in transitional areas between two subzones/variants, aspect often compensates for other climatic influences).

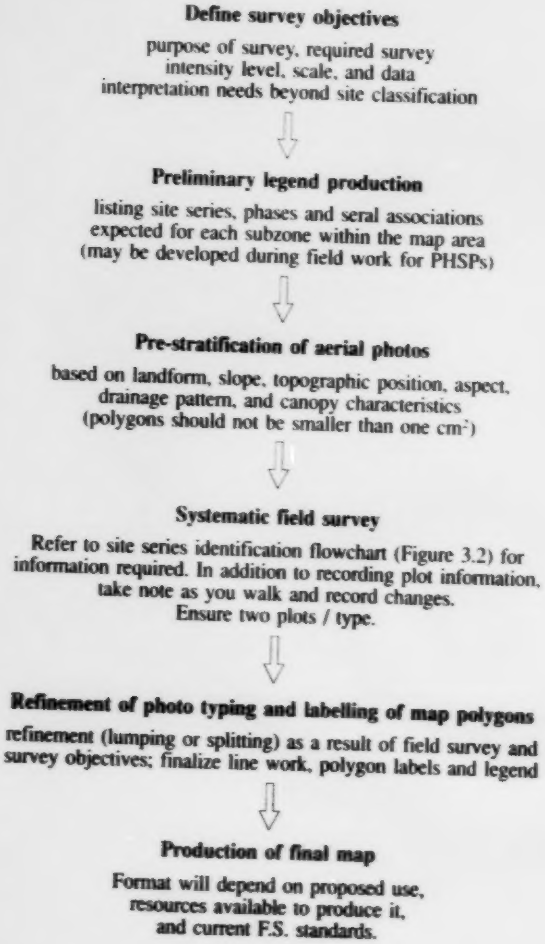
3.4.7 Identifying seral ecosystems

The biogeoclimatic classification was developed by sampling climax and late seral vegetation (forest stands older than 80 years). Therefore, when attempting to assess recently disturbed or seral sites, environmental features must be more heavily relied upon. Since there can be considerable overlap in environmental features among site series, disturbed sites are often difficult to identify. Remnant vegetation (e.g., on sites not burned nor heavily mechanically site prepared) may help the assessment. Otherwise, vegetation in a nearby stand with similar environmental features can be used.

3.5 Mapping Site Units

An ecosystem map is a valuable tool for effective integrated planning within a management area. A map provides a permanent record of the location and distribution of ecosystems, and thus provides a basic framework for developing site-specific management prescriptions that can be prepared for several resource values. A map also provides a means of monitoring prescription outcomes in the long-term and subsequently refining interpretations. Preharvest silviculture prescriptions (PHSPs) legally require biogeoclimatic classification of proposed cutblocks and the extra effort required to produce a map of a small management area during the ecological stand survey is minimal. If the survey is initiated with mapping in mind, then a more systematic, efficient, and thorough survey will result. Once they have been mapped, the site series should be grouped or split into treatment units. A treatment unit is an area (usually within a cutblock) that consists of one or more site series or a subdivision of site series that can be managed through the uniform application of harvesting techniques, silviculture treatments, and stocking standards. The resulting map may have fewer or more treatment units than actual site series.

Standard methods of ecosystem mapping, are presented in Mitchell *et al.* (1989) for large areas and Mitchell *et al.* (1991) for PHSPs. Figure 3.4 briefly outlines the mapping procedure.



Define survey objectives

purpose of survey, required survey
intensity level, scale, and data
interpretation needs beyond site classification

⇩

Preliminary legend production

listing site series, phases and seral associations
expected for each subzone within the map area
(may be developed during field work for PHSPs)

⇩

Pre-stratification of aerial photos

based on landform, slope, topographic position, aspect,
drainage pattern, and canopy characteristics
(polygons should not be smaller than one cm^2)

⇩

Systematic field survey

Refer to site series identification flowchart (Figure 3.2) for
information required. In addition to recording plot information,
take note as you walk and record changes.
Ensure two plots / type.

⇩

Refinement of photo typing and labelling of map polygons

refinement (lumping or splitting) as a result of field survey and
survey objectives; finalize line work, polygon labels and legend

⇩

Production of final map

Format will depend on proposed use,
resources available to produce it,
and current F.S. standards.

FIGURE 3.4. **Mapping flowchart for producing a site series or treatment unit map (1:5 000 to 1:20 000 scale).**

3.6 Management Interpretations

In Chapter 5, tables entitled *Management Interpretations* outline common growth-limiting factors, relative tree productivity, vegetation potential, road drainage control needs, common site sensitivity to disturbance, and other prescription considerations on a site series basis for each subzone/variant. Users of this table must recognize that it presents *common* conditions based on the sample plots summarized in the environment tables; actual conditions may vary on a site- specific basis.

Caution: The table provides a framework to assist users in identifying key factors in decision-making, and it should be revised according to local experience. It contains some key considerations for management prescriptions at the stand (site series) level. Many additional factors and other resource values must be contemplated at the landscape level, and these are considered at various other stages of forest planning (e.g., 5-year development plans, Local Resource Use Plans, and PHSPs).

Tree species selection guidelines and Nelson Forest Region silvicultural stocking standards are presented by site series in Appendix 1.

Many other interpretations apply at the subzone level (or to groups of site series). A common reason is that climate, as expressed by subzone, is the overriding influence on the interpretation. Subzone/variant level interpretations are included in several places throughout the guide. On the subzone summary pages are interpretations for the presence of dry or frozen soils and depth of snowpack, and wildlife concerns. Chapter 6 describes, for each subzone/variant or grouping of subzones/variants, wildlife presence, use of seral stages, and habitat elements. Chapter 7 summarizes forest health concerns by subzone/variant. Appendix 10 contains suggested forage and erosion control seeding mixes by groups of site series within subzones/variants.

The contents of the management interpretation tables are described below.

3.6.1 Common growth limiting factors

This is the keystone interpretation. Many others, such as other prescription considerations, species selection and stocking, reflect the influence of these ecological factors.

The *common* growth limiting factors for early tree growth and establishment were derived for each site series sample plot data with the use of the "Fire Effects Expert System" computer model[12] (Curran *et al.* 1991). This model summarizes the effects of a management activity (e.g., slashburning) on the ecological growth factors of seedlings. The "no treatment" baseline limitations are summarized here and include air temperature (frost), vegetation, soil temperature, soil moisture (both deficiency and excess), and soil nutrients. All factors except vegetation can be considered constraints on overall ecosystem productivity. Vegetation can be considered a constraint to tree establishment and growth or a resource for wildlife or range use; more detail is provided under *Vegetation Potential* (Section 3.6.3).

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[12] Available from regional pedologist, Nelson Forest Region.

For this guide, *common* site conditions for each site series were entered into the model to evaluate each growth factor. The results showed which of the growth limiting factors were considered to have a "high" or more severe limitation. These were then entered on the *Management Interpretations* table, and represent the *common* growth limitations that should be considered in the development of most forest management prescriptions.

> **Caution:** Other factors may also be limiting on a particular site. It is strongly recommended that the SYTEPREP expert system[13] be used with actual site data to compare possible site preparation treatments during prescription development.

To assist in using this information, some general implications of the factors and ratings follow.

> **Cold air temperature** indicates sites that are subjected to sublethal or lethal frosts during the growing season. Frost hardy species should be considered. Some forms of site preparation or partial cutting may help alleviate this problem.
>
> **Vegetation** indicates sites that have High or Very High vegetation potential, which is described in Section 3.6.3.
>
> **Cold soil** indicates sites where soil temperature is expected to significantly limit root development, affecting tree growth. Some types of site preparation (e.g. mounding) can help alleviate this problem by enhancing soil warming.
>
> **Dry soil** indicates sites where a significant growing season moisture deficit is expected to occur. Drought tolerant species and/or some forms of site preparation (e.g., mixing disturbances) can help alleviate this problem. In hot subzones/variants, partial cutting on south-facing aspects can be helpful in avoiding direct sunlight on regeneration.
>
> **Wet soil** indicates sites where an excess of soil moisture is expected to prevail during the growing season. Moisture tolerant species and/or some forms of site preparation (e.g., mounding) can help alleviate this problem.
>
> **Nutrients** are considered highly limiting on sites with a High or Very High forest floor displacement hazard. Planting of less nutrient demanding species (e.g., Pl, Lw) and conservation of forest floor (nutrient capital) can help alleviate this problem.

3.6.2 Relative productivity

Relative forest productivity indicates the severity of the limiting factors. Low productivity, for example, indicates very high limitations. Relative productivity may be considered to represent the relative viability of timber management activities from a relative resource value or economic perspective. For example, on a high productivity site, it may be possible to manage the forest economically and meet another resource use objective, whereas this would be more difficult on a low productivity site. Similarly, some forms of intensive silviculture (other than fertilization) often achieve the best economic returns on high productivity sites.

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[13] Available from regional pedologist, Nelson Forest Region.

Relative productivity is presented in three forms:

1. a site index value;
2. a corresponding growth class (low, poor, medium and good); and
3. a gross volume class (very low, low, medium, high, and very high).

The data come from mensuration plots associated with most of the 1288 ecological plots sampled in the Nelson Forest Region.

The site index values are from a recent data analysis that estimates site quality based on the total height (m) of the co-dominant trees in a stand referenced at 50 years breast height age. Relatively shade-intolerant species (Douglas-fir and spruce) were selected over very shade-tolerant species because they are better indicators of site potential. This resulted in small samples sizes for many site series. The shade-tolerant species often exhibit signs of suppression and therefore do not always reflect the true site productivity. The corresponding growth classes are from B.C. Ministry of Forests, Inventory Branch (1983).

The *gross* volume classes are based on the mean *gross* live and dead fibre volume for the site series sample plots. This resulted in a reasonable sample size similar to that noted for each site series. The classes are relative within the Nelson Forest Region, ranging from very low to very high. The numbers associated with the classes are *gross* fibre volumes, not recoverable volumes. The classes are very low (<200 m^3 gross fibre/ha), low (200 - 400), medium (400 - 600), high (600 - 800), and very high (>800 m^3 gross fibre/ha). These classes are for comparison purposes only.

3.6.3 Vegetation potential

Understory vegetation can itself be a resource (e.g., for wildlife browse or berry production) or it can be a constraint to timber production (e.g., competing with crop trees). Vegetation potential and commonly expected vegetation complexes are presented in the tables and were determined from local knowledge of common species cover and height, and from research results on competition. The vegetation potential rating is for post-harvest conditions and is relative within the Nelson Forest Region, ranging from low to very high. Site series with a high vegetation potential will usually require some form of vegetation management to control the vegetation during seedling establishment and early stand development. Conversely, high vegetation potential often represents good production of wildlife forage species, when present. Even a low level of vegetation potential can have a significant impact on tree survival and growth, especially where other growth factors are extremely limiting (e.g., grass competition on xeric sites).

The general meaning of the classes is presented below:

Vegetation potential	*Vegetation management for timber production*	*Wildlife forage production*
Very high	Almost always necessary	Very good
High	Usually necessary	Good
Moderate	Seldom necessary	Moderate
Low	Not necessary (except for grass on dry sites)	Poor

Commonly expected complexes have been identified for each site series. Fourteen of the 22 major vegetation complexes identified by Newton and Comeau (1990) commonly occur in the Nelson Forest Region. Three other complexes, shown in the tables here, are primarily for non-forested sites: *grass* (dominantly bluebunch wheatgrass), *sedge* (fens), and *bog* (sphagnum moss). Vegetation management interpretations for timber production are contained in operational summaries for the mixed shrub, ericaceous shrub, fireweed, willow, dry alder, wet alder and pinegrass complexes (available from the Forest Sciences Section, Nelson Region).

3.6.4 Road drainage control needs

Drainage control is a very important aspect of the planning, construction, maintenance, and deactivation of forest roads, trails, and landings. The drainage control needs rating (low, medium, high) indicates the importance of maintaining *natural* drainage patterns. Inadequate drainage control can lead to disastrous consequences, including landslides and siltation of water courses. The ratings are general, given that actual site-specific drainage control needs will vary according to site-specific conditions such as soil texture, slope, seepage/water table, and downslope risks to other resource values. This interpretation is based on the subzone/variant "R-factor"[14] and moisture regime.

The ratings provide general interpretations of the amount of effort required to maintain adequate drainage under average site conditions, assuming that roads and landings are built to Nelson Forest Region Engineering Standards. The ratings recognize planning and maintenance needs at a broad level and, if the site is visited during the dry season, act as a reminder of expected peak spring and fall runoff.

> **Caution:** This interpretation is not intended to substitute for site-specific interpretations that are based on regional standards for road construction and maintenance, or on other specific standards (e.g., for consumptive use watersheds).

A site with a *high* road drainage control need will receive higher peak runoff during spring and fall, and will thus require more construction and maintenance effort to ensure that drainage control is adequate. Conversely, a site with a *low* drainage control need will receive lower peak runoffs, and will require fewer resources to ensure that adequate drainage control is maintained.

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[14] The "R-factor," also known as the "rainfall factor," provides a rating of maximum climatic potential for runoff from snowmelt or intense convectional storms (whichever is greater). They are summarized for site sensitivity evaluation in Curran *et al.* (1990).

3.6.5 Site sensitivities

Site sensitivity is the inherent sensitivity of a site to soil disturbance. This factor is based on the five site sensitivity keys (compaction, displacement, surface erosion, mass wasting and forest floor displacement hazard) presented in Curran *et al.* (1990). These underlie the Interior Harvesting Guidelines[15] and the Interior Mechanical Site Preparation Guidelines[16]. A field form is available for assessing these sensitivities[17].

Sample plot attributes used to determine the hazards include: soil texture, soil depth, coarse fragment content, forest floor depth, depth to unfavourable substrate, slope and slope position. Climate, as indicated by subzone, is also taken into account.

> **Caution:** Other site sensitivities may exist on a particular site. The table displays only the hazards that are *commonly* high or very high on the site series. This information does not substitute for the PHSP requirement of determining the site sensitivities based on the actual site data; it simply identifies the *common* constraints to mechanical operations and the common slope process hazards, based on the sample plot data.

Strategies to minimize disturbance are presented for harvesting by Lewis *et al.* (1989) and for site preparation by Curran *et al.* (1990). To assist in using this information, some general implications of the individual site sensitivities and their ratings follow.

> **Compaction hazard** indicates the susceptibility of the soil to compaction from machinery. High and Very High hazard sites are often silty or clayey textured. Low ground pressure equipment, designated skidroads, or operating on a snowpack or dry soil can help to minimize compaction.
>
> **Displacement hazard** indicates the degree of hazard for *mineral soil* displacement. High hazard sites often have unfavourable substrates; exposure of these should be avoided by minimizing side cutting and scalping. Very High hazard sites often have steeper slopes as well (>30%) and machine operations should be minimized.
>
> **Erosion hazard** indicates the degree of hazard for surface water erosion from exposed mineral soil (e.g., skidroads or rutting). A number of climatic, topographic, and soil factors contribute to these ratings. High hazard sites require careful attention to drainage control and waterbarring. Very High hazard sites are more sensitive, particularly if adjacent to important watercourses or their tributary gullies. Waterbarring and culverting requirements related to erosion hazard are presented in Regional engineering specifications.

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[15] Available from Timber Section or Pedologist, Nelson Forest Region.

[16] Available from Silviculture Section or Pedologist, Nelson Forest Region.

[17] This form (Supplemental Preharvest Silvicultural Prescription Field Form) and its use are described in Mitchell *et al.* (1991).

Forest floor displacement hazard indicates the degree of sensitivity of the site to forest floor removal, usually because of nutrient and organic matter depletion. High hazard sites normally have limited organic matter which should be conserved. Very High hazard sites are even more sensitive and any practices that deplete organic matter must be questioned (e.g., whole tree harvesting, prescribed burning, etc.).

Mass wasting hazard, as summarized here, indicates the degree of hazard for road cut and fill related failures. The user must recognize that unstable terrain would be rated higher. Road drainage problems are the major cause of landslide problems in the Nelson Forest Region. High hazard areas are often difficult for maintaining drainage because of minor slumping or ravelling into ditches. Very High hazards are much more of a problem and may actually be inoperable.

3.6.6 Other prescription considerations

The following considerations, related to site series, appear in the tables and must be taken into account when treatments are being prescribed. As well, numerous logistical, stand, forest health and other resource values not related to site series must be considered and are discussed in other manuals related to PHSPs (e.g., Mitchell *et al.* 1991) and the Preharvest Silviculture Prescription Standard Operating Procedures.

Conserve (limited) organic matter: sites with a high forest floor displacement hazard where most of the available nutrient capital is contained in shallow surface organic layers or where the organic layers represent important rooting medium due to shallow water tables. Any mechanical treatments should ensure the forest floor is left near the seedlings. Prescribed burning should be avoided unless minimal forest floor consumption can be ensured or the site has a high forest floor displacement hazard because of a shallow water table.

Frost prone sites: sites that may require either thermal shelter or frost-resistant species for successful regeneration.

Machine travel on snow or dry soil: sites with a high compaction hazard, which are expected to have >1 m snowpack and soils that dry out for an extended period. Random machine travel on snow or dry soil may be a good strategy to minimize soil disturbance.

Minimize machine travel: sites with a high compaction hazard, which are expected to have <1 m snowpack, ground that does not freeze, and soils that never dry out for an extended period. Avoid random machine travel and designate skidroads prior to harvest.

No timber values: grassland, grassland-forest transition, talus or bedrock outcrops, and fen or bog wetland sites; may contain scattered trees but should not be considered part of the timber land base; often important sites for wildlife, rare plants and recreation.

Partial cutting recommended: for sites where regeneration in full sunlight is difficult (often forest-grassland ecotones).

Partial cutting questionable: sites with high windthrow hazard (see below) and/or high vegetation potential.

Random machine travel on frozen ground: sites with a high compaction hazard, which are expected to have <1 m snowpack and soils that never dry out for an extended period, but may have frozen soil to an adequate depth. Random skidding on frozen ground may be a good strategy to minimize soil disturbance.

Random machine travel on snow: sites with a high compaction hazard where soils are rarely dry, but are expected to have >1 m snowpack. Random skidding on snow may be a good strategy to minimize soil disturbance.

Riparian zones: sites influenced by or influencing streams, rivers or other water bodies. These areas are very important to wildlife, water quality, visual and recreational values.

Seedbanking species prolific after fire: sites with a dry shrub complex. The species in this complex are fire-adapted. Sites with dense stands may have very low levels of seedbanking shrubs because of the low light levels before harvest.

Special road construction/maintenance: sites with high or very high road cut and fill mass wasting hazards (see Section 3.6.5). Where such sites must be traversed, special construction and maintenance prescriptions should be developed to mitigate possible adverse effects. In particular, ensure that natural drainage patterns are preserved.

Unfavourable substrate: sites with a high displacement hazard because of the presence of dense materials, bedrock, water table, calcareous, or very coarse soils. Any mechanical operations should be carried out in a way to minimize displacement.

Vegetation more prolific on flat sites: based on observations of a study in the Revelstoke Forest District.

Water table may rise after harvest: sites with the water table within 30 cm of the surface. After removal of trees, water may rise to surface, making regeneration very difficult.

Windthrow hazard: sites with shallow rooting caused by high water tables. While sites with shallow soils often have a windthrow problem, this also depends on exposure, topography, cutblock layout, and other factors that preclude this type of windthrow hazard from being presented here. *The user of this table must still consider these other windthrow hazards.*

4 CLIMATIC REGIONS AND BIOGEOCLIMATIC ZONES OF THE NELSON FOREST REGION

by

M.P. Curran, T.F. Braumandl, and D.L. DeLong

4.1 Introduction

Three climatic regions (wet, moist, and dry) have been identified in the Nelson Forest Region based on very broad climatic patterns (Figure 4.1). Although not part of the formal BEC classification, the climate regions are expressed by differing biogeoclimatic zone and subzone/variant sequences with changes in elevation. The dry climate region occupies rain shadows of the Coast and Columbia Mountains, namely the Okanagan Highlands, Kettle River, and lower Granby River areas in the western portion of the region and the Rocky Mountain Trench and most of the southern Rocky Mountains in the East Kootenay. The moist and wet climate regions occupy all areas between and north of the dry climate region.

The Nelson Forest Region encompasses six biogeoclimatic zones: the Ponderosa Pine (PP), Interior Douglas-fir (IDF), Montane Spruce (MS), Interior Cedar - Hemlock (ICH), Engelmann Spruce - Subalpine Fir (ESSF), and Alpine Tundra (AT) zones (Figure 4.2). Thorough descriptions of these zones and subzones may be found in "Ecosystems of British Columbia" (Meidinger and Pojar 1991). Detailed descriptions of the subzones and variants of this region are provided in Chapter 5 of this guide. The Nelson Forest Region biogeoclimatic zones are briefly described in this chapter and their sequences in the three climatic regions are outlined below.

In the dry climate region, the Ponderosa Pine (PP), Interior Douglas-fir (IDF), and Montane Spruce (MS) zones occur in a sequence from the driest valley bottoms to the subalpine forests. The Engelmann Spruce - Subalpine Fir zone (ESSF) occurs in the Okanagan Highlands and Rocky Mountains above the MS. On high mountains, particularly in the Rockies, the Alpine Tundra zone (AT) occurs above the ESSF.

The moist and wet climatic regions occupy part of what is commonly referred to as the "Interior Wet Belt", which also extends north and west into the Prince George, Cariboo, and Kamloops Forest Regions. The sequence of biogeoclimatic zones is the same in the moist and wet climatic regions. The ICH occupies valley bottoms and lower slopes with the ESSF above. The AT occurs above the ESSF. The AT starts at lower elevations and is more widespread in the wet climatic region. The moist and wet regions include all the area between the two dry regions, from Christina Lake to Moyie Lake in the south, running north, just east of the Purcell Divide to Golden and to the western and northern limits of the Nelson Forest Region.

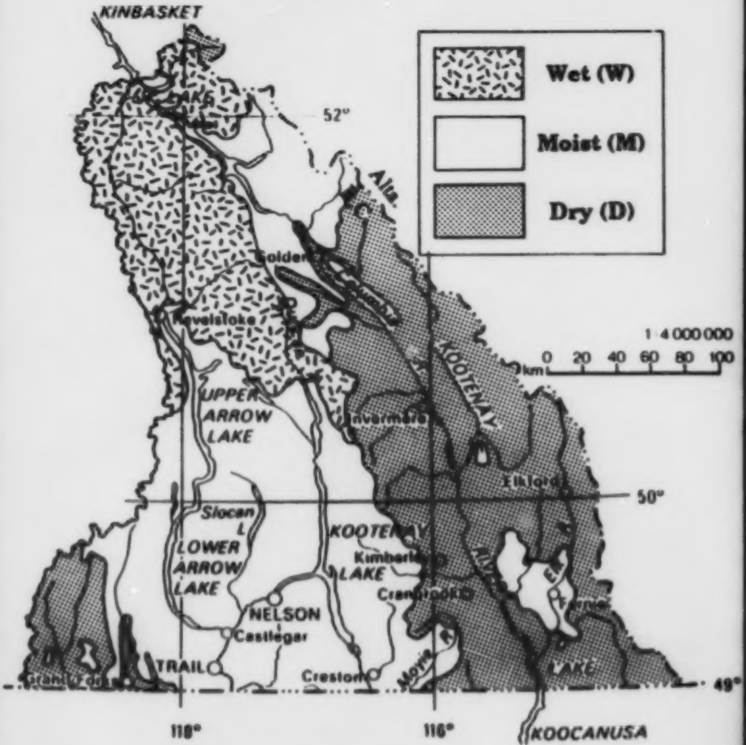
KINBASKET
LAKE
52°
Alta.
Golden
Revelstoke
Columbia
KOOTENAY
R.
UPPER ARROW LAKE
Invermere
Elkford
50°
Slocan L
LOWER ARROW LAKE
KOOTENAY LAKE
Kimberley
Cranbrook
NELSON
Castlegar
TRAIL
Grand Forks
Creston
Moyie R.
ELK R.
Fernie
LAKE
KOOCANUSA
49°
118°
116°
Wet (W)
Moist (M)
Dry (D)
1:4 000 000
0 20 40 60 80 100
km

FIGURE 4.1. Climatic regions of the Nelson Forest Region.

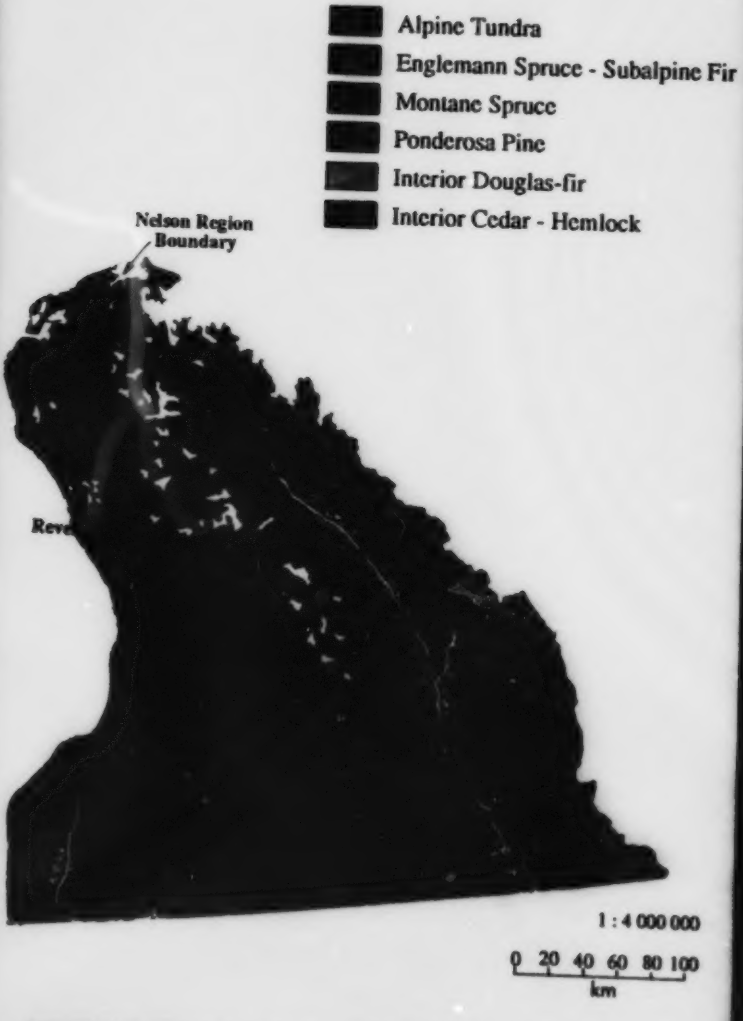
Alpine Tundra
Englemann Spruce - Subalpine Fir
Montane Spruce
Ponderosa Pine
Interior Douglas-fir
Interior Cedar - Hemlock
Nelson Region Boundary
Reve
1 : 4 000 000
0 20 40 60 80 100
km

FIGURE 4.2. Biogeoclimatic zones of the Nelson Forest Region.

The wet climatic region occurs in the northern half of the area, where the mountains are higher, resulting in enhanced precipitation. The wet climatic region starts at the northern end of the Purcell Wilderness Conservancy, running up the west side of the Purcells and angling over to Revelstoke, north of Duncan and Trout Lakes, encompassing all the northern Selkirks and the Monashees at mid and high elevations north of Shelter Bay.

Table 4.1 describes the names, tree species, and elevation ranges of the subzones/variants of the Nelson Forest Region. Table 4.2 describes their climate.

The following sections briefly describe the biogeoclimatic zones of the region. Climate region vegetation tables (Tables 4.3, 4.4, 4.5) describe the zonal vegetation of the subzones; their use in subzone identification is described in Sections 3.2.1 and 3.4.1.

TABLE 4.1. Subzone/variant names, tree species and elevation

Biogeoclimatic zone	**Climate region**	**Map symbol**	**Subzone/ variant**	**Tree species** [a]	**Elevation ranges S=South aspect N=North aspect**
PP Ponderosa Pine	Dry	PPdh1	Kettle Dry Hot Ponderosa Pine Variant	**Py, Fd** At, Ac, Sxw, (Lw[b]), [-Pl[c]]	500-950m^{S}
	Dry	PPdh2	Kootenay Dry Hot Ponderosa Pine Variant	**Py, Fd** Sxw, At, Ac, (Lw, Pl)	700-950m^{S}
IDF Interior Douglas-fir	Dry	IDFxh1[d]	Okanagan Very Dry Hot Interior Douglas-fir Variant	**Fd, Py** At, Ep, (Lw), [-Pl]	500-1200m^{S} 500-1050m^{N}
	Dry	IDFun	Undifferentiated Interior Douglas-fir Subzone	**Fd**	
	Dry	IDFdm1	Kettle Dry Mild Interior Douglas-fir Variant	**Fd** Lw, Pl, Py, Sxw, At, Ac, Ep, (Cw)	500-1370m^{S} 500-1280m^{N}
	Dry	IDFdm2	Kootenay Dry Mild Interior Douglas-fir Variant	**Fd** Py, Lw, Pl, Sxw, At, Ac, (Ep)	800-1200m^{S} 800-1100m^{N}
ICH Interior Cedar - Hemlock	Moist	ICHxw	Very Dry Warm Interior Cedar - Hemlock Subzone	**Cw, Bg** Lw, Fd, Pl, Py, Sxw, At, Ac, Ep, Bl, Hw, Pw	450-1100m^{S}
	Moist	ICHdw	Dry Warm Interior Cedar - Hemlock Subzone	**Hw, Cw, Ac, (Bl)** Lw, Fd, Pl, Py, Sxw, Pw, Bg, Ep, At	450-1200m^{S} 450-1000m^{N}
	Moist	ICHmw1	Golden Moist Warm Interior Cedar - Hemlock Variant	**Hw, Cw** Fd, Pl, Sxw, Pw, Ep, Ac, (Bl), [-Lw]	750-1550m^{S} 750-1500m^{N}
	Moist	ICHmw2[e]	Columbia-Shuswap Moist Warm Interior Cedar - Hemlock Variant	**Hw, Cw** Fd, Pl, Pw, Sxw, At, Lw, Ac, Ep, Bl, [-Bg, -Py]	500-1450m^{S} 500-1400m^{N}

TABLE 4.1. (Continued)

Biogeoclimatic zone	Climate region	Map symbol	Subzone/ variant	Tree species ^{a}	Elevation ranges S=South aspect N=North aspect
ICH Interior Cedar - Hemlock	Moist	ICHmw3^{d}	Thompson Moist Warm Interior Cedar - Hemlock Variant	**Hw, Cw** Fd, Pl, Pw, Sxw, Bl, At, Ep, Ac, [-Lw]	400-1400m^{S} 400-1350m^{N}
	Moist	ICHmk1	Kootenay Moist Cool Interior Cedar - Hemlock Variant	**Cw, Sxw** Lw, Fd, Pl, Py, Ep, At, Ac, Bl, (Pw, Hw)	800-1550m^{S} 750-1500m^{N}
	Wet	ICHwk1	Wells Gray Wet Cool Interior Cedar - Hemlock Variant	**Hw, Cw** Fd, Bl, Sxw, Ep, Ac, Pw, (Lw, Pl, At)	400-1400m^{S} 400-1350m^{N}
	Wet	ICHvk1	Mica Very Wet Cool Interior Cedar - Hemlock Variant	**Hw, Cw** Fd, Pw, Sxw, Ep, Ac, (Bl, At), [-Pl, -Lw]	550-1350m^{S} 550-1350m^{N}
MS Montane Spruce	Dry	MSdk	Dry Cool Montane Spruce Subzone	**Se, Bl, (Fd)** Fd, Pl, Lw, At, Ac, Ep, (Sxw, Cw)	1200-1650m^{S} 1100-1550m^{N}
	Dry	MSdm1	Okanagan Dry Mild Montane Spruce Variant	**Se, Bl, (Fd)** Ac, Ep, (Sxw)	1370-1650m^{S} 1280-1550m^{N}
ESSF Engelmann Spruce - Subalpine Fir	Dry	ESSFdk	Dry Cool Engelmann Spruce - Subalpine Fir Subzone	**Se, Bl** Pa, Pl, La, At (Fd^{f}, Lw^{f})	1650-2100m^{S} 1550-2100m^{N}
	Dry	ESSFdkp	Dry Cool Parkland Engelmann Spruce - Subalpine Fir Subzone	**Se, Bl** Pa, La	2100-2600m^{S} 2100-2600m^{N}
	Dry	ESSFdcl	Okanagan Dry Cold Engelmann Spruce - Subalpine Fir Variant	**Se, Bl** Pl, (Pa, At)	1650-1950m^{S} 1550-1950m^{N}
	Moist	ESSFwm	Wet Mild Engelmann Spruce - Subalpine Fir Subzone	**Bl, Se** (Hw, Pw, Pl, Lw)	1600-1950m^{S} 1500-1950m^{N}

TABLE 4.1. (Continued)

Biogeo-climatic zone	Climate region	Map symbol	Subzone/ variant	Tree species [a]	Elevation ranges S=South aspect N=North aspect
ESSF Engelmann Spruce - Subalpine Fir	Moist	ESSFwmp	Wet Mild Parkland Engelmann Spruce - Subalpine Fir Subzone	**Bl, Se** Pa, La	1950-2600m^{S} 1950-2600m^{N}
	Moist, Wet	ESSFwc1	Columbia Wet Cold Engelmann Spruce - Subalpine Fir Variant	**Se, Bl** Hw, Cw, Pl, (Fd, Pw, Lw, Pa)	1450-1650m^{S} 1400-1600m^{N}
	Moist, Wet	ESSFwc2[d]	Northern Monashee Wet Cold Engelmann Spruce - Subalpine Fir Variant	**Se, Bl** Pl, (Fd)[f]	1450-1800m^{S} 1400-1800m^{N}
	Moist, Wet	ESSFwc4	Selkirk Wet Cold Engelmann Spruce - Subalpine Fir Variant	**Se, Bl** Pl, Pa	1650-1950m^{S} 1600-1950m^{N}
	Moist, Wet	ESSFwcp	Wet Cold Parkland Engelmann Spruce - Subalpine Fir Subzone	**Se, Bl** La, Pa	1950-2440m^{S} 1950-2400m^{N}
	Wet	ESSFvc	Very Wet Cold Engelmann Spruce - Subalpine Fir Subzone	**Se, Bl, Hm** (Cw[f], Hw[f])	1350-1800m^{S} 1250-1800m^{N}
	Wet	ESSFvcp	Very wet Cold Parkland Engelmann Spruce - Subalpine Fir Subzone	**Se, Bl, Hm** Pa	1800-2300m^{S} 1800-2300m^{N}

TABLE 4.1. (Concluded)

Biogeo-climatic zone	Cli-mate region	Map symbol	Subzone/ variant	Tree species [a]	Elevation ranges S=South aspect N=North aspect
AT Alpine Tundra	Dry, Moist, Wet	AT			Min. Elev. 2600 m in Dry Region; 2400 m in Moist Region; 2300 m in Wet Region

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[a] Species in bold type are zonal climax, other species are seral or non-zonal species.

[b] ( ) Bracketted species are rare species.

[c] [-] Square brackets and minus sign denote diagnostic absence of species.

[d] Please refer to Kamloops Forest Region Fieldguide (Lloyd *et al.*, 1990) for site identification and management interpretations for the IDFxh1, ICHmw3, and ESSFwc2. These variants are of limited extent in the Nelson Region.

[e] The southern portion of this variant is found above the ICHdw, i.e., at elevations of 1200-1550 m.

[f] These species occur in the lower elevations of the subzone/variant.

TABLE 4.2. Climatic characteristics of the Nelson Forest Region subzones/variants

Subzone/ variant[a]	Number of climate stations[b]	Mean annual precipitation[c] (mm)	Mean summer precipitation (mm)	Mean annual snowfall (mm)	Growing degree days (>5°C)	Frost-free period (days)
PPdh1	1	447 --	181 --	123 --	1928 --	132 --
PPdh2	4	484 403-606	227 165-270	129 109-170	1777 1712-1861	117 107-128
IDFxh1	12 *	428 345-547	165 113-248	136 91-168	1915 1615-2366	129 8-198
IDFun	1[d]	498 --	203 --	122 --	1918 --	160 --
IDFdm1	2	541 511-571	211 181-243	184 138-230	1603 1512-1693	119 93-145
IDFdm2	14	455 369-577	197 158-291	187 121-379	1437 1197-1668	96 42-122
ICHxw	3	640 569-696	211 200-218	179 149-205	1948 1890-2038	140 126-160
ICHdw	18	740 566-941	243 189-300	239 122-496	1870 1475-2140	143 90-184
ICHmw1	1	1064 --	325 --	422 --	1808 --	149 --
ICHmw2	5**	840 661-1113	294 229-393	304 204-556	1792 1673-1988	149 127-169
ICHmw3	3**	1004 896-1171	307 275-336	461 460-462	1435 --	136 89-165
ICHmk1	1	1128 --	322 --	397 --	1398 --	95 --
ICHwk1	5**	1214 868-1725	385 325-461	588 375-1090	1364 991-1808	121 104-149
ICHvk1	1	1419 --	331 --	734 --	1387 --	138 --
MSdk	4	580 505-660	229 192-272	276 193-342	1209 1109-1310	68 20-126
MSdm1	2*	618 572-664	227 201-252	338 311-365	891 --	33 20-46
ESSFdk	2	783 726-841	279 272-286	544 425-612	1000 --	55 49-61
ESSFvc	1	1606 --	407 --	1106 --	801 --	79 --
ESSFvcp	1	2169 --	562 --	1974 --	671 --	75 --
AT	1	756 --	287 --	551 --	427 --	21 --

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[a] No data for ESSFdkp, ESSFdc1, ESSFwm, ESSFwmp, ESSFwc1, ESSFwc2, ESSFwc4, and ESSFwcp.

[b] Number of climate stations in Nelson Forest Region with the following exceptions: * Kamloops Region only; ** Nelson and Kamloops Regions.

[c] Climate data (mean and ranges given) compiled from the 1951-1980 climate normals for British Columbia. Long-term records from the AES were used to normalize short-term records from AES and Ministry of Environment stations (G. Reynolds, 1991, Climate Data Summaries for the Biogeoclimatic Zones of British Columbia, Version 3, BC Ministry of Forests. Unpublished report).

[d] Deer Park station.

TABLE 4.3. Zonal vegetation for subzones in the dry climatic region

	Subzone	PPdh	IDFxh	IDFdm	MSdm	MSdk	ESSFdc	ESSFdk	
TREES	*Pseudotsuga menziesii*	7 - 15%	>25%	>25%	1 - 7%	7 - 15%			Douglas-fir
	Pinus ponderosa	1 - 7%	7 - 15%						ponderosa pine
	Larix occidentalis			7 - 15%					western larch
	Pinus contorta			16 - 25%	16 - 25%	16 - 25%	16 - 25%	<1%	lodgepole pine
	Abies lasiocarpa				16 - 25%	7 - 15%	>25%	>25%	subalpine fir
	Picea glauca x engelmannii				16 - 25%	16 - 25%			hybrid white spruce
	Picea engelmannii						16 - 25%	16 - 25%	Engelmann spruce
SHRUBS	*Amelanchier alnifolia*	1 - 7%	1 - 7%	<1%					saskatoon
	Rosa woodsii	1 - 7%							prairie rose
	Spiraea betulifolia		16 - 25%	1 - 7%					birch-leaved spirea
	Symphoricarpos albus		7 - 15%			<1%			common snowberry
	Shepherdia canadensis			1 - 7%		1 - 7%			soopolallie
	Paxistima myrsinites			1 - 7%	16 - 25%				falsebox
	Vaccinium membranaceum				7 - 15%		16 - 25%	1 - 7%	black huckleberry
	Menziesia ferruginea					7 - 15%		>25%	false azalea
	Rhododendron albiflorum						>25%		white-flowered rhododendron
	Ribes lacustre				<1%			1 - 7%	black gooseberry
HERBS	*Agropyron spicatum*	>25%							bluebunch wheatgrass
	Antennaria microphylla	1 - 7%							rosy pussytoes
	Calamagrostis rubescens		>25%	>25%	1 - 7%	1 - 7%		<1%	pinegrass
	Arctostaphylos uva-ursi			7 - 15%					kinnikinnick
	Linnaea borealis			7 - 15%	1 - 7%	1 - 7%			twinflower
	Vaccinium scoparium				7 - 15%	7 - 15%	16 - 25%	1 - 7%	grouseberry
	Rubus pedatus				<1%		1 - 7%		five-leaved bramble
	Arnica latifolia						1 - 7%	1 - 7%	mountain arnica
	Arnica cordifolia		1 - 7%	<1%		1 - 7%		1 - 7%	heart-leaved arnica
	Vaccinium myrtillus							1 - 7%	low bilberry
	Tiarella trifoliata var. unifoliata				<1%			1 - 7%	one-leaved foamflower
MOSSES AND LICHENS	*Peltigera* spp.		1 - 7%		<1%				lichen
	Pleurozium schreberi		1 - 7%		16 - 25%	>25%		7 - 15%	red-stemmed feathermoss
	Hylocomium splendens					7 - 15%			step moss
	Cladonia spp.				<1%		<1%		cladonias
	Ptilium crista-castrensis							1 - 7%	knight's plume

Approximate Cover Classes: <1% 1 - 7% 7 - 15% 16 - 25% >25%

TABLE 4.4. Zonal vegetation for subzones in the moist climatic region

	Subzone	ICHxw	ICHdw	ICHmk	ICHmw	ESSFwm	ESSFwc	
TREES	*Pinus ponderosa*	7 - 15%	<1%					ponderosa pine
	Pseudotsuga menziesii	>25%	15 - 25%	7 - 15%	1 - 7%			Douglas-fir
	Thuja plicata	7 - 15%	15 - 25%	7 - 15%	15 - 25%			western redcedar
	Tsuga heterophylla	7 - 15%	15 - 25%		>25%			western hemlock
	Betula papyrifera	1 - 7%	7 - 15%					paper birch
	Pinus contorta	1 - 7%	1 - 7%	15 - 25%				lodgepole pine
	Larix occidentalis		1 - 7%	7 - 15%	<1%			western larch
	Abies lasiocarpa			15 - 25%		>25%	>25%	subalpine fir
	Picea glauca x engelmannii			7 - 15%	<1%			hybrid white spruce
	Picea engelmannii					>25%	15 - 25%	Engelmann spruce
SHRUBS	*Philadelphus lewisii*	1 - 7%						mock-orange
	Symphoricarpus albus	7 - 15%						common snowberry
	Corylus cornuta	1 - 7%						beaked hazelnut
	Acer glabrum	7 - 15%						Douglas maple
	Amelanchier alnifolia	<1%	<1%					saskatoon
	Mahonia aquifolium	1 - 7%	<1%					tall Oregon-grape
	Rosa gymnocarpa	1 - 7%	1 - 7%					baldhip rose
	Paxistima myrsinites		7 - 15%	15 - 25%	7 - 15%	<1%		falsebox
	Vaccinium membranaceum		1 - 7%	1 - 7%	1 - 7%	15 - 25%	15 - 25%	black huckleberry
	Lonicera utahensis			1 - 7%	<1%	7 - 15%	1 - 7%	Utah honeysuckle
	Rhododendron albiflorum					7 - 15%	>25%	white-flowered rhododendron
	Ribes lacustre					1 - 7%	1 - 7%	black gooseberry
	Menziesia ferruginea					15 - 25%		false azalea
HERBS	*Disporum* spp.	1 - 7%						fairybells
	Aralia nudicaulis	<1%	1 - 7%					wild sarsaparilla
	Chimaphila umbellata	<1%	7 - 15%	1 - 7%	1 - 7%			prince's pine
	Linnaea borealis	1 - 7%	15 - 25%	7 - 15%	1 - 7%			twinflower
	Clintonia uniflora	1 - 7%	7 - 15%	1 - 7%	1 - 7%	1 - 7%		queen's cup
	Rubus pedatus			<1%	<1%	<1%	7 - 15%	five-leaved bramble
	Tiarella trifoliata var. *unifoliata*				1 - 7%	7 - 15%	15 - 25%	one-leaved foamflower
	Gymnocarpium dryopteris					15 - 25%	15 - 25%	oak fern
	Valeriana sitchensis						7 - 15%	Sitka valerian
	Arnica latifolia					7 - 15%	1 - 7%	mountain arnica
MOSSES AND LIVERWORTS	*Pleurozium schreberi*		<1%	15 - 25%	15 - 25%			red-stemmed feathermoss
	Rhytidiopsis robusta	1 - 7%			15 - 25%	7 - 15%	1 - 7%	pipecleaner moss
	Mnium spp.					1 - 7%	7 - 15%	leafy mosses
	Barbilophozia lycopodioides					<1%	1 - 7%	common leafy liverwort

Approximate Cover Classes: ▭ <1% ▭ 1 - 7% ▭ 7 - 15% ▭ 15 - 25% ▭ >25%

TABLE 4.5. Zonal vegetation for subzones in the wet climatic region

	Subzone	ICHwk	ICHvk	ESSFwc	ESSFvc	
TREES	*Tsuga heterophylla*	>25%	>25%			western hemlock
	Thuja plicata	15 - 25%	>25%			western redcedar
	Abies lasiocarpa			>25%	15 - 25%	subalpine fir
	Picea engelmannii		1 - 7%	15 - 25%	15 - 25%	Engelmann spruce
	Tsuga mertensiana				7 - 15%	mountain hemlock
SHRUBS	*Paxistima myrsinites*	1 - 7%				falsebox
	Lonicera utahensis	<1%		1 - 7%		Utah honeysuckle
	Vaccinium ovalifolium	1 - 7%	1 - 7%	<1%	7 - 15%	oval-leaved blueberry
	Vaccinium membranaceum		1 - 7%	15 - 25%	15 - 25%	black huckleberry
	Oplopanax horridus	<1%	>25%			devil's club
	Ribes lacustre			1 - 7%		black gooseberry
	Rhododendron albiflorum			>25%	15 - 25%	white-flowered rhododendron
	Menziesia ferruginea	<1%	<1%		7 - 15%	false azalea
HERBS	*Clintonia uniflora*	7 - 15%	1 - 7%		1 - 7%	queen's cup
	Tiarella trifoliata var. unifoliata	7 - 15%	15 - 25%	15 - 25%	1 - 7%	one-leaved foamflower
	Gymnocarpium dryopteris	7 - 15%	>25%	15 - 25%	15 - 25%	oak fern
	Dryopteris expansa	1 - 7%	15 - 25%		1 - 7%	spiny wood fern
	Athyrium filix-femina	<1%	>25%		1 - 7%	lady fern
	Rubus pedatus	1 - 7%	1 - 7%	7 - 15%	7 - 15%	five-leaved bramble
	Arnica latifolia			1 - 7%		mountain arnica
	Valeriana sitchensis			7 - 15%	15 - 25%	Sitka valerian
MOSSES AND LIVERWORTS	*Pleurozium schreberi*	15 - 25%	<1%		1 - 7%	red-stemmed feathermoss
	Rhytidiopsis robusta	15 - 25%	1 - 7%	1 - 7%	1 - 7%	pipecleaner moss
	Hylocomium splendens	7 - 15%				step moss
	Mnium spp.	1 - 7%	7 - 15%	7 - 15%	1 - 7%	leafy mosses
	Barbilophozia lycopodioides			1 - 7%	1 - 7%	common leafy liverwort

Approximate Cover Classes: ▫ <1% ▭ 1 - 7% ▭ 7 - 15% ▭ 15 - 25% ▭ >25%

4.2 Ponderosa Pine Zone (PP)

The PP is restricted to the driest sections of the southern Rocky Mountain Trench, north of Cranbrook and on the southeast side of Lake Koocanusa, and to sections of the Kettle River Valley around Midway and Grand Forks. On zonal sites of the PP, open stands of ponderosa pine are common. Grasses, predominantly bluebunch wheatgrass, dominate the understory.

Two variants of the dry hot PP subzone (PPdh) occur in the Nelson Forest Region. The PPdh1 occurs in the west and the PPdh2 is located in the southern Rocky Mountain Trench.

4.3 Interior Douglas-fir Zone (IDF)

In the East Kootenay, the IDF surrounds the PP, covering much of the Rocky Mountain Trench as far north as Golden. The zone also runs up the Granby River north of Grand Forks, and is quite extensive north and west of Midway into the Okanagan Highlands. Zonal sites in the IDF typically have pure Fd or mixed seral stands of Fd, Lw, and Pl. The understory is dominated by pinegrass and shrubs such as birch-leaved spirea and soopolallie.

Three IDF variants occur in the Nelson Forest Region: the IDFdm1, IDFdm2, and IDFxh1 (Table 4.1). Two undifferentiated IDF units are also recognized. The IDFdm2 is the most widespread IDF variant in the region and occurs in valley bottoms and lower slopes of the Rocky Mountain Trench and major tributary valleys from Golden south. The IDFdm1 occurs in the Kettle, West Kettle, Boundary, and Granby drainages around Grand Forks.

The IDFxh1 occurs in valley bottoms and lower slopes from Christina Lake to Grand Forks and from Midway to Rock Creek between the PPdh1 and the IDFdm1.

The two undifferentiated IDFun units cover small areas in the East and West Kootenay. One occurs on south-facing, lower slopes on the east side of Lower Arrow Lake, from Syringa Creek Park north to Broadwater. The other occurs in valley bottoms and lower slopes from Canal Flats to Invermere.

4.4 Montane Spruce Zone (MS)

The MS occurs in the dry climatic region on the mid-slopes of the Rocky Mountain Trench and the Rockies south of Golden and the eastern Purcell Mountains south of the Spillimacheen River. In the west, the MS is located on mid-slopes in the Okanagan Highlands and Midway Range of the Monashee Mountains. Zonal sites in the MS commonly have Sxw and Bl with an understory of Utah honeysuckle, grouseberry, twinflower, and pinegrass. Seral Pl stands are common due to frequent fires in the past.

The MSdk and the MSdm1 are the two MS subzones/variants that occur in the Nelson Forest Region. The MSdk is more widespread and occurs in the East Kootenay. The MSdm1 is found in the western part of the region and also occurs in the Kamloops Forest Region.

4.5 Interior Cedar - Hemlock Zone (ICH)

The ICH is one of the largest zones in the Nelson Forest Region along with the ESSF and AT. The zone occupies the lower slopes of the Rocky Mountains, north of Golden and around Fernie and the Columbia Mountains. Zonal sites in the ICH typically have Cw and Hw with an understory of black huckleberry, queen's cup, and bunchberry. The ICH has the greatest tree species diversity of all the zones in British Columbia.

There are eight ICH subzones/variants in the Nelson Forest Region. The ICHxw, ICHdw, ICHmk1, ICHmw1, ICHmw2, and ICHmw3 (Table 4.1) are located in the moist climatic region, while the ICHwk1 and the ICHvk1 are located in the wet climatic region.

The ICHxw is the smallest and driest ICH subzone in the Nelson Forest Region. It is located in the Pend D'Oreille Valley and on western and southern exposures on lower slopes above Kootenay Lake south of Boswell and along the Goat River from Creston to Kitchener.

The ICHdw occurs in a band below the ICHmw2 in the valley bottoms and lower slopes of the southern Columbia Mountains.

The ICHmw2 is the largest ICH subzone/variant in the Nelson Forest Region and occurs above the ICHdw on lower slopes of the southern Columbia Mountains. It can be found in valley bottoms north of the ICHdw.

The ICHmw1 is found on lower to mid-slopes in the Rocky Mountains from Golden to the Sullivan River and in the northern Selkirks from Parson to Gold River.

The ICHmk1 occurs on lower to mid-slopes of the southwestern Monashees northwest of Grand Forks, the southern Rockies around Fernie, and the Rocky Mountain Trench from Parson to Donald.

The ICHwk1 and ICHvk1 variants are located in the more northern parts of the Nelson Forest Region in the wet climatic region. The ICHwk1 is located in the valley bottoms and lower slopes of the upper Duncan River and the Columbia River drainages from Revelstoke to Goldstream River and along the west shore of Kinbasket Lake from Gold River north to the regional boundary. The ICHvk1 is located in the valley bottoms and lower slopes in the Selkirk and Monashee Mountains from the Goldstream River to Mica Creek.

4.6 Engelmann Spruce - Subalpine Fir Zone (ESSF)

The ESSF is the largest zone in the Nelson Forest Region. The ESSF occurs at higher elevations (above the MS or ICH) throughout the region. Closed canopy forests of Se and Bl are common at lower and middle elevations of the ESSF. Subalpine parkland, consisting of tree islands interspersed with herb-dominated meadows, is found commonly at upper elevations. Vegetation on zonal sites characteristically includes black huckleberry and white-flowered rhododendron and/or false azalea. Seral Pl stands are common in subzones/variants with a frequent fire history. Deciduous trees are uncommon in the ESSF.

There are seven ESSF subzones/variants in the Nelson Forest Region. The ESSFdc1 and ESSFdk are located in the dry climatic region; ESSFwc1, ESSFwc2, ESSFwc4, and ESSFwm are found primarily in the moist climatic region (found less commonly in the wet climatic region); and the ESSFvc is located in the wet climatic region (Table 4.1).

The ESSFdc1, one of the driest variants in the zone, is located above the MSdm1 on the upper slopes of the Okanagan Highlands and Midway Range of the Monashees.

The ESSFdk is located on the upper slopes of the Rocky Mountains and eastern Purcell Mountains south of the Spillimacheen River to the U.S. border.

The ESSFwc1 is a narrow 200 m elevational band located south of Revelstoke in the Monashee and Selkirk mountains. This variant is a transition between the ICH and ESSF zones, as is evidenced by the presence of Cw and Hw in the understory. The ESSFwc1 occurs below the ESSFwc4 and above the ICHmw2, ICHwk1, or ICHmk1.

The ESSFwc2 occurs in a small area in the northern Monashees, north of Nagle Creek; northern Selkirks, north of Windy Creek; and north of Sullivan River on the east side of Kinbasket Lake at the northern end of the Region.

The ESSFwc4 is the most extensive ESSF variant in the Nelson Forest Region. It is located on the upper slopes of the Monashee and Selkirk Mountains south of Revelstoke.

The ESSFwm is located on the upper slopes of the western Purcells and the Rocky Mountains around Fernie and north of Golden.

The ESSFvc is located north of Revelstoke on the upper slopes of the Selkirk and Monashee Mountains.

4.7 Alpine Tundra Zone (AT)

The Alpine Tundra zone is one of the largest in the Nelson Forest Region. It occurs at the highest elevations in all mountain ranges. The most extensive areas of AT occur in the northern Selkirks and the Rocky Mountains. Much of the AT is rock, talus, snow and ice. The sparse vegetation varies but often contains willows, buttercups, saxifrages, pussytoes, sedges, grasses, Sitka valerian, mountain-avens, or mountain-heathers. Conifers are only present in stunted krummholz forms.

5

BIOGEOCLIMATIC SUBZONES AND VARIANTS OF THE NELSON FOREST REGION

by

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5.1 Dry Climatic Region

PPdh1

Variant Summary

Kettle Dry Hot Ponderosa Pine Variant

Location: The southern extremities of the Kettle River Valley. Valley bottoms and mid to lower elevations on south-facing slopes and terraces between Johnstone Creek and Boundary Falls and between July Creek and Christina Lake. It is more widespread in the USA.

Elevation range: 500 to 950 m.

Climate[18]**:** Dry Climatic Region; very hot, very dry summers; mild winters with very light snowfall. Soils are expected to dry out for long to short time periods during late summer. Snow accumulations are insignificant and of very short duration, but soils generally do not freeze due to the mild, dry climate. Lack of soil moisture is a major limitation to tree growth, along with frost on level or depressional sites.

Soils, geology, and landforms: Common rock types in the PPdh1 include andesite, gneiss, schist, granite, sandstone, conglomerate and basalt. Upper, steeper slopes are covered by loamy textured colluvial soils and sandy textured glaciofluvial soils. These soils tend to have sandy subsurface textures. Bedrock commonly occurs within 15-50 cm of the surface on colluvial soils. Lower slopes are covered by sandy to loamy fluvial soils and loamy to silty morainal soils. Silty textured loess cappings often occur in this variant. Restricting layers and calcareous subsoils occur below the surface in many of the deeper soils.

Zonal vegetation: Zonal sites have open stands of Py with an understory dominated by bluebunch wheatgrass, cheatgrass, junegrass, and arrow-leaved balsamroot. Grassland sites (site series 03) are more common than the forested zonal sites in this variant.

Distinguishing the PPdh1 from adjoining subzones/variants

In the IDFdm1 most sites have:	- falsebox - more soopolallie, birch-leaved spirea, tall Oregon-grape, kinnikinnick, and heart-leaved arnica - less cheatgrass, arrow-leaved balsamroot, narrow-leaved collomia, tall tumble-mustard, small-flowered blue-eyed Mary, junegrass, Kentucky bluegrass, and yellow salsify
zonal sites also have:	- Pl, Lw, common juniper and pinegrass - more Fd
dry sites have:	- less compact selaginella
wet sites have:	- Sxw and Cw, Utah honeysuckle, black twinberry, black gooseberry, thimbleberry, highbush-cranberry, and lady fern - more trailing raspberry - less common dandelion
In the IDFxh1 zonal sites have:	- pinegrass - no bluebunch wheatgrass - more Fd, birch-leaved spirea and tall Oregon-grape

Forest characteristics: The PPdh1 is dominated by grassland and open Py stands. Frequent low intensity ground fires are the major disturbance feature.

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[18] Values for climate descriptors given in Appendix 12.

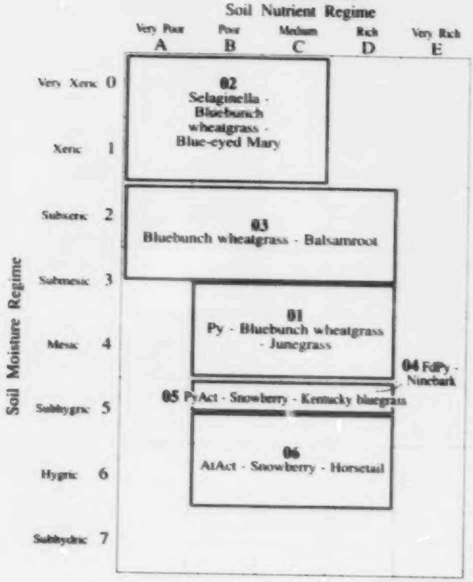
Range characteristics: Area is heavily infested with weeds (knapweeds, common hound's-tongue, leafy spurge). Disturbance should be minimized; any essential soil disturbance should be seeded immediately to prevent invasion of weeds.

The classification of grasslands for this variant is based on good range condition data. The most notable feature for deteriorating condition is the reduction in cover of bluebunch wheatgrass.

Wildlife habitat: Grasslands in this variant are essential for the survival of rare species such as Burrowing Owl, Brewer's Sparrow, badger, and Great Basin pocket mouse. Talus and rocky cliffs are important habitat for gopher snake, western rattlesnake, and the endangered Canyon Wren. Snags, dead and down material, and cover patches are used by many species as nest and feeding sites. The variant also provides winter range for white-tailed deer, mule deer, and bighorn sheep.

PPdh1

Edatopic Grid


Soil Nutrient Regime
Very Poor A
Poor B
Medium C
Rich D
Very Rich E
Soil Moisture Regime
Very Xeric 0
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02 Selaginella - Bluebunch wheatgrass - Blue-eyed Mary
03 Bluebunch wheatgrass - Balsamroot
01 Py - Bluebunch wheatgrass - Junegrass
04 FdPy - Ninebark
05 PyAct - Snowberry - Kentucky bluegrass
06 AtAct - Snowberry - Horsetail

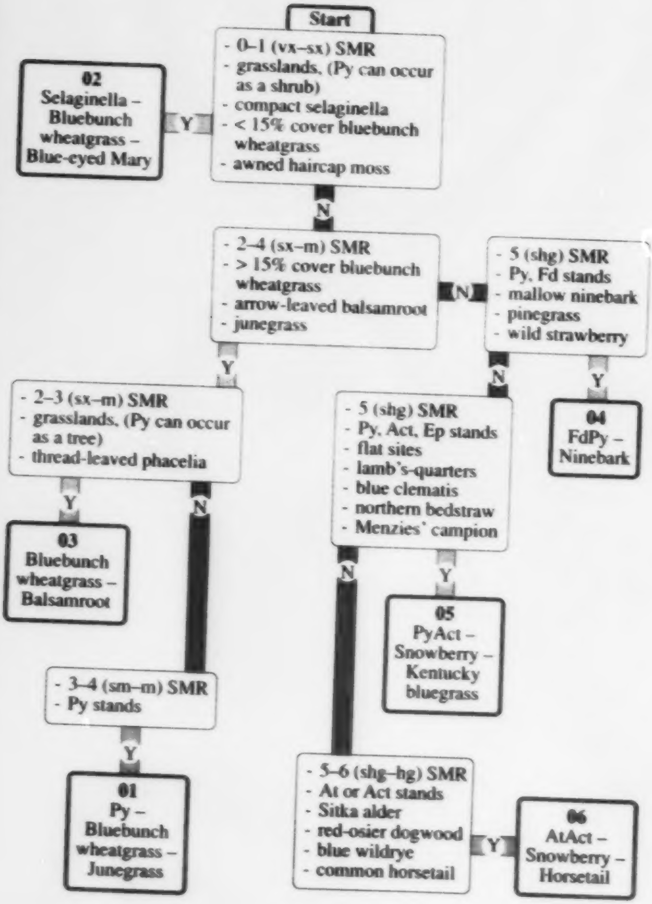
PPdh1 Vegetation Table

	Site Series	02	03	01	04	05	06	
TREES	*Pinus ponderosa*			>25%	15 - 25%	15 - 25%		ponderosa pine
	Pseudotsuga menziesii				>25%	7 - 15%		Douglas-fir
	Populus balsamifera					15 - 25%	15 - 25%	black cottonwood
	Betula papyrifera					7 - 15%		paper birch
	Populus tremuloides						>25%	trembling aspen
SHRUBS	*Amelanchier alnifolia*	<1%		<1%	1 - 7%	<1%	15 - 25%	saskatoon
	Physocarpus malvaceus				>25%			mallow ninebark
	Symphoricarpos albus	<1%		<1%	1 - 7%	1 - 7%	7 - 15%	snowberry
	Clematis occidentalis					<1%		blue clematis
	Alnus crispa ssp. sinuata						7 - 15%	Sitka alder
	Cornus stolonifera						7 - 15%	red-osier dogwood
HERBS	*Collinsia parviflora*	<1%						small-flowered blue-eyed Mary
	Selaginella densa	15 - 25%	1 - 7%					compact selaginella
	Phacelia linearis	<1%	<1%					thread-leaved phacelia
	Agropyron spicatum	7 - 15%	>25%	>25%	<1%			bluebunch wheatgrass
	Bromus tectorum	<1%	1 - 7%	7 - 15%	7 - 15%	1 - 7%		cheatgrass
	Balsamorrhiza sagittata	<1%	1 - 7%	1 - 7%	<1%			arrow-leaved balsamroot
	Koeleria macrantha	1 - 7%	1 - 7%	1 - 7%				junegrass
	Calamagrostis rubescens				>25%			pinegrass
	Fragaria virginiana				<1%			wild strawberry
	Poa pratensis					15 - 25%	1 - 7%	Kentucky bluegrass
	Smilacina stellata					1 - 7%	7 - 15%	star-flowered false Solomon's-seal
	Taraxacum officinale					1 - 7%	<1%	common dandelion
	Aster conspicuus					<1%	<1%	showy aster
	Chenopodium album					<1%		lamb's-quarters
	Galium boreale					1 - 7%		northern bedstraw
	Silene menziesii					1 - 7%		Menzies' campion
	Sisymbrium altissimum					<1%		tall tumble-mustard
	Thlaspi arvense					<1%		field pennycress
	Equisetum arvense						7 - 15%	common horsetail
	Aralia nudicaulis						<1%	wild sarsaparilla
	Elymus glaucus						1 - 7%	blue wildrye
MOSSES AND LICHENS	*Polytrichum piliferum*	15 - 25%	<1%	<1%				awned haircap moss
	Cladonia spp.	7 - 15%		<1%				cladonias
	Tortula ruralis	1 - 7%	<1%					sidewalk moss

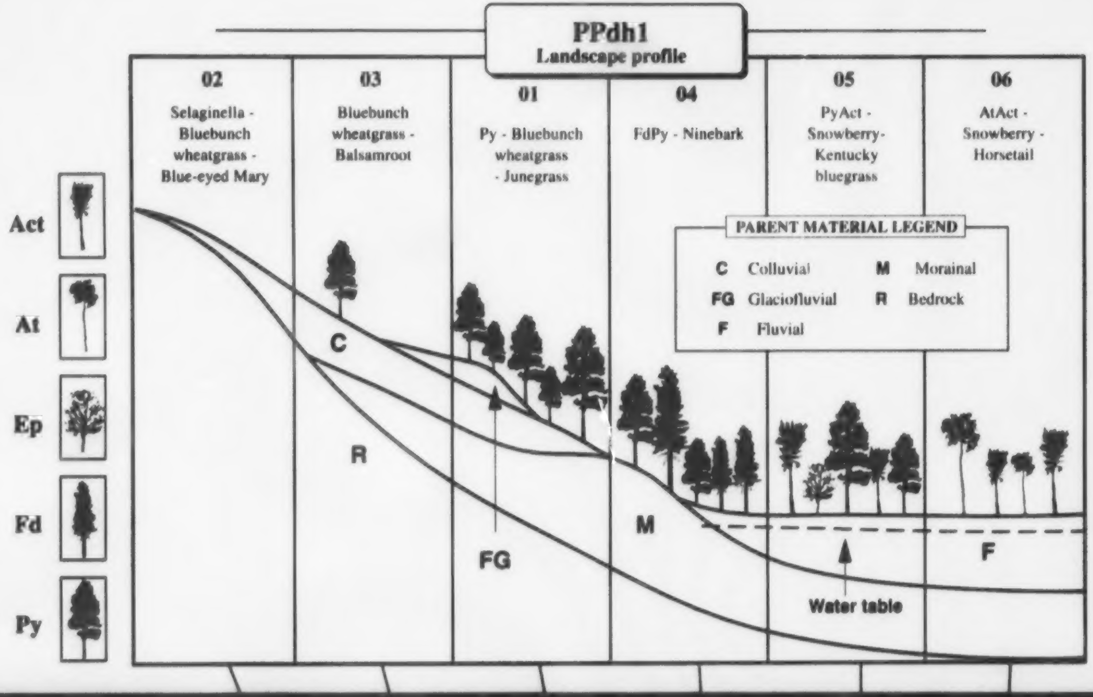
Approximate Cover Classes: ▭ <1% ▭ 1 - 7% ▭ 7 - 15% ▭ 15 - 25% ▭ >25%

PPdh1

Site Series Flowchart


Start
- 0–1 (vx–sx) SMR
- grasslands, (Py can occur as a shrub)
- compact selaginella
- < 15% cover bluebunch wheatgrass
- awned haircap moss
Y
02 Selaginella – Bluebunch wheatgrass – Blue-eyed Mary
N
- 2–4 (sx–m) SMR
- > 15% cover bluebunch wheatgrass
- arrow-leaved balsamroot
- junegrass
N
- 5 (shg) SMR
- Py, Fd stands
- mallow ninebark
- pinegrass
- wild strawberry
Y
04 FdPy – Ninebark
N
Y
- 2–3 (sx–m) SMR
- grasslands, (Py can occur as a tree)
- thread-leaved phacelia
Y
03 Bluebunch wheatgrass – Balsamroot
N
- 3–4 (sm–m) SMR
- Py stands
Y
01 Py – Bluebunch wheatgrass – Junegrass
- 5 (shg) SMR
- Py, Act, Ep stands
- flat sites
- lamb's-quarters
- blue clematis
- northern bedstraw
- Menzies' campion
Y
05 PyAct – Snowberry – Kentucky bluegrass
N
- 5–6 (shg–hg) SMR
- At or Act stands
- Sitka alder
- red-osier dogwood
- blue wildrye
- common horsetail
Y
06 AtAct – Snowberry – Horsetail

Y = Yes; N = No


PPdh1
Landscape profile
02
Selaginella - Bluebunch wheatgrass - Blue-eyed Mary
03
Bluebunch wheatgrass - Balsamroot
01
Py - Bluebunch wheatgrass - Junegrass
04
FdPy - Ninebark
05
PyAct - Snowberry - Kentucky bluegrass
06
AtAct - Snowberry - Horsetail
PARENT MATERIAL LEGEND
C Colluvial
FG Glaciofluvial
F Fluvial
M Morainal
R Bedrock
C
R
FG
M
F
Water table
Act
At
Ep
Fd
Py

PPdh1 Environmental Table

Site series		**02**	**03**	**01**	**04**	**05**	**06**
Number of plots		5	15	7	7	4	3
Soil moisture regime[a] (SMR)		(0)[b]1(2) (vx)x(sx)	2-3(4) sx-sm(m)	3-4 sm-m	5 shg	5 shg	5(6) shg(hg)
Aspect		warm or n.a.	mostly warm	variable	variable	n.a.	n.a.
Slope gradient %		variable	20-50	26-65	variable	0	0
Slope position		crest (level)	crest-mid	upper-mid	variable, mostly lower	lower	level (lower)
Parent material		C	C(FG)	C,FG	M,F	F	F
Soil texture coarse fragments % (min.-**mean**-max.)	0-30 cm	L(S,$) 30-**32**-40	L(S) 25-**42**-60	L(C,S,$) 2-**28**-42	L($) 0-**20**-40	S,L 0	S,$,L 0
	30+ cm	S 40-**40**-40	L,S(C,$) 30-**52**-75	S,$,L 5-**28**-45	L(C,S,$) 3-**31**-55	S,L 0	S,$,L 0-**20**-60
Humus form — LFH thickness cm (min.-**mean**-max.)		Mull 0	Mull 0-**0.5**-4	Moder (Mull) 0-**3**-8	Moder 1-**3**-8	Moder 1-**2**-6	Mull 1-**1**-9
Important site features		restricting layer common; average depth 15 cm	restricting layer common; average depth 50 cm	—	some colluvial or fluvial veneers	—	water table below 35 cm; may find thick moder humus

[a] Environmental features contained in this table are defined in Section 3.4.4.
[b] Values in brackets less common.

PPdh1

Management Interpretations[a]

Site series	Number of plots	Common seedling growth limiting factors[a,b]	Relative tree productivity		Vegetation potential - common complexes[c]	Road drainage control needs (see cautions[a,e])	Common site sensitivities (see cautions[a,d])	Other prescription considerations
			Gross volume productivity	Growth class (site index, tree species)				
02	5	Dry soil	n.a.	n.a.	Low - grass	Low	H displacement hazard on all sites; H forest floor displacement hazard on moderate slopes	No timber values; Conserve limited organic matter on moderate and steeper slopes
03	16	Dry soil	n.a.	n.a.	Medium - grass	Low	H displacement hazard on moderate slopes	No timber values
01	7	Dry soil	Very low	Medium[f] (17, Fd)	Medium - grass	Low	H displacement hazard on steep slopes; H forest floor displacement hazard on very steep slopes	Partial cutting recommended; Conserve limited organic matter on very steep slopes

04	7	Cold air temp., Dry soil	Low	Medium (18 Fd)	Medium - pinegrass	Moderate	H displacement hazard on steep slopes; H forest floor displacement hazard on very steep slopes	Partial cutting recommended; Flat sites frost prone; Conserve limited organic matter on very steep slopes
05	4	Cold air temp.	No data	Medium[f] (18, Fd)	Medium - grass	Moderate	....	Frost prone sites; Riparian
06	3	Cold air temp.	No data	No data	Medium - mixed shrub	Moderate	H compaction hazard on silty soils	Frost prone sites; Random machine travel during short period of dry soil conditions; Windthrow hazard; Riparian

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[a] **Caution:** Based on sample plot data; some interpretations expected to vary with individual site conditions. Use of original interpretive tools is necessary; these interpretations are presented here to "red flag" common concerns. This table outlines key considerations that should go into management decisions. Rationale and interpretive tools are discussed in Section 3.6.

[b] These include air temperature, soil temperature, vegetation, soil moisture, and soil nutrients; use of SYTEPREP recommended, see Section 3.6.1.

[c] Complexes described in Newton and Comeau (1990).

[d] **Caution:** This is presented here to "red flag" common drainage needs and is not intended to substitute for site specific engineering interpretations, see Section 3.6.4.

[e] **Caution:** Site sensitivity keys must be used with you site data for the PHSP; see section 3.6.5. H = high, 30 - 45% = moderate slope, 45 - 60% = steep slope, >60% = very steep slope.

[f] Sample size less than five plots for site index determination.

PPdh2

Variant Summary

Kootenay Dry Hot Ponderosa Pine Variant

Location: Rocky Mountain Trench between Skookumchuck Creek and the St. Mary River and between Baynes Lake and Tobacco Plains.

Elevation range: 700 to 950 m.

Climate[19]**:** Dry Climatic Region; very hot, dry summers; mild winters with very light snowfall. Soils generally dry out for long to short time periods during late summer. Snow accumulations are insignificant and of very short duration. As a result, soils may freeze to a shallow depth on some sites. Lack of soil moisture is a major limitation to tree growth. Frost may be a problem on level or depressional sites.

Soils, geology, and landforms: The soils of the PPdh2 are derived from deep sediments of glacial and recent origin. Exposed and near-surface bedrock are uncommon. Morainal soils with loamy or silty surface textures occur on a variety of slope gradients and positions. Glaciofluvial soils with sandy surface textures often occur in proximity to morainal soils. Fluvial and glaciolacustrine soils with gentle to level slopes occur on the lowest slope positions. Surface horizons for fluvial soils are loamy textured while lacustrine soils are silty textured. Eolian veneers (loess cappings) of silty texture, often occur in this variant. At depth, fluvial, glaciofluvial and morainal soils are often sandy in texture. Calcareous subsoil horizons are common.

Zonal vegetation: Zonal sites have open stands of Fd and Py with an understory of predominantly bluebunch wheatgrass. Other common species are saskatoon, prairie rose, and rosy pussytoes.

Distinguishing the PPdh2 from adjacent subzones/variants

In the **IDFdm2**, most sites have:	- Pl, Douglas maple, common juniper, tall Oregon-grape, and thimbleberry; - more heart-leaved arnica and asters; - less bluebunch wheatgrass;
zonal sites also have:	- more pinegrass;
dry sites have:	- no shaggy fleabane, prairie crocus, or rosy pussytoes;
wet sites have:	- trailing raspberry, wild sarsaparilla, and sweet-scented bedstraw; - more common horsetail.

Forest characteristics: This variant is dominated by drier sites and has had an extensive fire history. It has a legacy of intensive domestic grazing and selective logging. Coupled with a more recent trend toward fire management and controlled grazing, the area has become a complex mosaic of vegetation communities in response to the fluctuating disturbance and use.

Range characteristics: Forage is heavily used by elk in late winter and early spring. Forest ingrowth is a problem because of fire suppression. Noxious weeds are invading.

The classification of grasslands for this variant is based on good range condition data. The most notable feature for deteriorating range condition is the reduction in cover of bluebunch wheatgrass.

Wildlife habitat: Dry sites support Sharp-tailed Grouse and badgers, two rare species in the Nelson Forest Region. Preserving the grassland/forest mix for these and other species is important, as is management of winter range for elk, mule deer, and white-tailed deer. Mature and old-growth riparian forests provide essential habitats for Bald Eagle, Osprey, Great Blue Heron, and cavity-nesting ducks.

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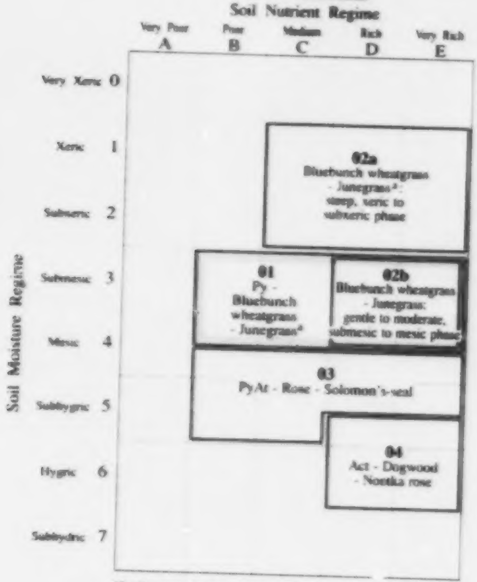
[19] Values for climate descriptors given in Appendix 12.

PPdh2

Edatopic Grid


Soil Nutrient Regime
Very Poor
A
Poor
B
Medium
C
Rich
D
Very Rich
E
Soil Moisture Regime
Very Xeric 0
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02a
Bluebunch wheatgrass
- Junegrass[a]:
steep, xeric to
subxeric phase
01
Py -
Bluebunch
wheatgrass
- Junegrass[a]
02b
Bluebunch wheatgrass
- Junegrass:
gentle to moderate,
submesic to mesic phase
03
PyAt - Rose - Solomon's-seal
04
Act - Dogwood
- Nootka rose

Shading used where considerable site series overlap occurs.

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[a] Junegrass uncommon in 02a and 01

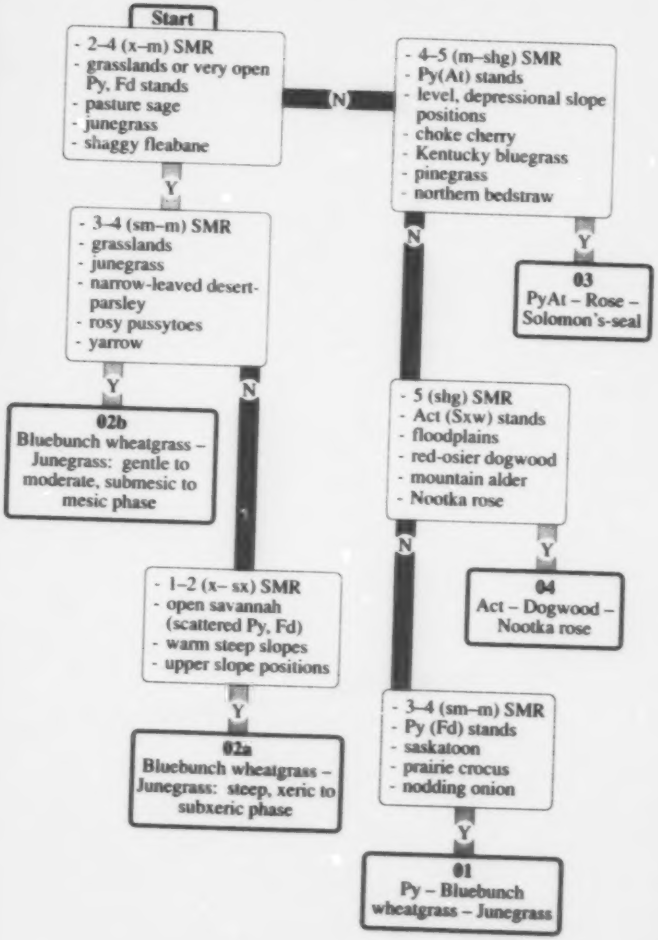
PPdh2 Vegetation Table

	Site Series/Phases	02a	02b	01	03	04	
TREES	*Pseudotsuga menziesii*	1 - 7%	<1%	7 - 15%			Douglas-fir
	Pinus ponderosa	<1%	<1%	1 - 7%	1 - 7%		ponderosa pine
	Populus tremuloides				>25%		trembling aspen
	Populus balsamifera					15 - 25%	black cottonwood
	Picea glauca x engelmannii					7 - 15%	hybrid white spruce
SHRUBS	*Artemisia frigida*	1 - 7%	1 - 7%				pasture sage
	Rosa woodsii		1 - 7%	1 - 7%	1 - 7%		praire rose
	Amelanchier alnifolia			1 - 7%	<1%	<1%	saskatoon
	Prunus virginiana				1 - 7%		choke cherry
	Symphoricarpos occidentalis				1 - 7%	<1%	western snowberry
	Rosa acicularis				7 - 15%	1 - 7%	prickly rose
	Cornus stolonifera					7 - 15%	red-osier dogwood
	Alnus incana ssp. tenuifolia					7 - 15%	mountain alder
	Rosa nutkana					7 - 15%	Nootka rose
HERBS	*Koeleria macrantha*	<1%	7 - 15%				junegrass
	Agropyron spicatum	>25%	>25%	>25%		<1%	bluebunch wheatgrass
	Achillea millefolium		<1%	<1%			yarrow
	Antennaria microphylla		<1%	1 - 7%			rosy pussytoes
	Anemone patens			<1%			prairie crocus
	Poa pratensis		<1%		>25%		Kentucky bluegrass
	Calamagrostis rubescens				1 - 7%		pinegrass
	Galium boreale				1 - 7%		northern bedstraw
	Taraxacum officinale				<1%	<1%	common dandelion
	Smilacina stellata				1 - 7%	<1%	star-flowered false Solomon's-seal
	Equisetum hyemale					<1%	scouring-rush

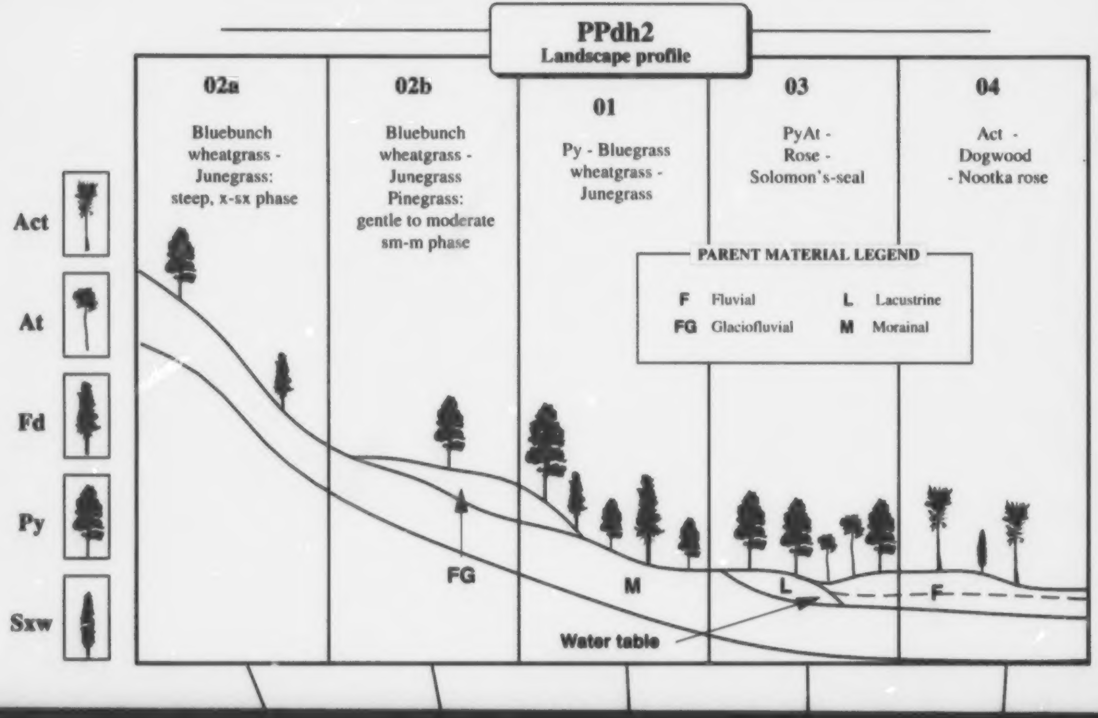
Approximate Cover Classes: ▫ <1% ▭ 1 - 7% ▭ 7 - 15% ▭ 15 - 25% ▭ >25%

PPdh2

Site Series Flowchart


Start
- 2–4 (x–m) SMR
- grasslands or very open Py, Fd stands
- pasture sage
- junegrass
- shaggy fleabane
N
- 4–5 (m–shg) SMR
- Py(At) stands
- level, depressional slope positions
- choke cherry
- Kentucky bluegrass
- pinegrass
- northern bedstraw
Y
- 3–4 (sm–m) SMR
- grasslands
- junegrass
- narrow-leaved desert-parsley
- rosy pussytoes
- yarrow
Y
03
PyAt – Rose – Solomon's-seal
N
Y
02b
Bluebunch wheatgrass – Junegrass: gentle to moderate, submesic to mesic phase
N
- 5 (shg) SMR
- Act (Sxw) stands
- floodplains
- red-osier dogwood
- mountain alder
- Nootka rose
Y
04
Act – Dogwood – Nootka rose
N
- 1–2 (x– sx) SMR
- open savannah (scattered Py, Fd)
- warm steep slopes
- upper slope positions
Y
02a
Bluebunch wheatgrass – Junegrass: steep, xeric to subxeric phase
- 3–4 (sm–m) SMR
- Py (Fd) stands
- saskatoon
- prairie crocus
- nodding onion
Y
01
Py – Bluebunch wheatgrass – Junegrass

Y = Yes; N = No


PPdh2
Landscape profile
02a
Bluebunch wheatgrass - Junegrass: steep, x-sx phase
02b
Bluebunch wheatgrass - Junegrass Pinegrass: gentle to moderate sm-m phase
01
Py - Bluegrass wheatgrass - Junegrass
03
PyAt - Rose - Solomon's-seal
04
Act - Dogwood - Nootka rose
PARENT MATERIAL LEGEND
F Fluvial
FG Glaciofluvial
L Lacustrine
M Morainal
FG
M
L
F
Water table
Act
At
Fd
Py
Sxw

PPdh2 Environmental Table

Site series/phases		02a	02b	01	03	04
Number of plots		5	12	11	3	1
Soil moisture regime[a] (SMR)		(1)[b]2 (x)sx	3(4) sm(m)	3(4) sm(m)	4-5 m-shg	shg
Aspect		warm	mostly warm	variable	n.a.	n.a.
Slope gradient %		45-60	0-45	0-50	0	0
Slope position		upper	variable	variable	level-depression	level
Parent material		M	M(FG)	M(L,FG)	L,F	F
Soil texture coarse fragments % (min.-**mean**-max.)	0-30 cm	L 30-**35**-43	$,L(S) 0-**19**-32	$,L(S) 0-**13**-25	$(L) 0-**1**-3	L 0-**0**-0
	30+ cm	L,S 50-**64**-70	S,C,L($) 0-**39**-60	S,L($,C) 0-**38**-67	S($) 0-**3**-8	$ 45-**45**-45
Humus form — LFH thickness cm (min.-**mean**-max.)		Mull 0-**1**-1	Mull, Mor 0-**0.5**-2	Mull, Moder 1-**4**-8	Moder 5-**8**-11	Moder 5
Important site features		restricting layer common 50-100 cm; some eolian veneers	eolian veneers common	eolian veneers common	—	recent floodplains

[a] Environmental features contained in this table are defined in Section 3.4.4.
[b] Values in brackets less common.

PPdh2

Management Interpretations[a]

Site series	Number of plots	Common seedling growth limiting factors[a,b]	Relative tree productivity		Vegetation potential - common complexes[c]	Road drainage control needs (see cautions[a,e])	Common site sensitivities (see cautions[a,e])	Other prescription considerations
			Gross volume productivity	Growth class (site index, tree species)				
02a	5	Dry soil	n.a.	Low[f] (9, Fd)	Low - grass	Low	H displacement hazard on all sites	No timber values
02b	12	Dry soil	Nonforested to Very low	Poor (14, Fd)	Medium - grass	Low	H displacement hazard on silty soils	No timber values
01	11	Dry soil, Cold air temp.	Very low	Poor (14, Fd)	Medium - grass	Low	H compaction hazard on silty soils	Partial cutting recommended; Random machine travel when soil dry
03	3	Cold air temp., Dry soil	Low	No data	Medium - dry shrub, pinegrass	Moderate	H compaction hazard on silty soils	Frost prone sites; Seedbanking species prolific after fire; Random machine travel when soil dry; Riparian

04	1	Cold air temp.	Low	No data	Medium - wet alder	Moderate	--------	Frost prone sites; Riparian

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[a] **Caution:** Based on sample plot data; some interpretations expected to vary with individual site conditions. Use of original interpretive tools is necessary; these interpretations are presented here to "red flag" common concerns. This table outlines key considerations that should go into management decisions. Rationale and interpretive tools are discussed in Section 3.6.

[b] These include air temperature, soil temperature, vegetation, soil moisture, and soil nutrients; use of SYTEPREP recommended, see Section 3.6.1.

[c] Complexes described in Newton and Comeau (1990).

[d] **Caution:** This is presented here to "red flag" common drainage needs and is not intended to substitute for site specific engineering interpretations, see Section 3.6.4.

[e] **Caution:** Site sensitivity keys must be used with your site data for the PHSP; see Section 3.6.5.

H = high.

[f] Sample size less than five plots for site index determination.

IDFxh1

Variant Summary

Okanagan Very Dry Hot Interior Douglas-fir Variant

Location: In the Nelson Forest Region, the IDFxh1 occurs in valley bottoms and lower slopes from Christina Lake to Grand Forks, including the Granby River, from Midway to Rock Creek, and up the Kettle River to Westbridge. It also occurs south of Rock Creek along Myers Creek to the U.S. border.

This subzone occurs more extensively in the Kamloops Forest Region. Please refer to " A Guide to Site Identification and Interpretation for the Kamloops Forest Region " (Lloyd et al. *1990) for a detailed description of vegetation and environmental features and management interpretations.*

Elevation range: 500 to 1200 m (south aspect); 500 to 1050 m (north aspect).

Zonal vegetation: Zonal climax sites have stands of Fd and Py. Birch-leaved spirea and snowberry are the most common shrubs. Pinegrass is the dominant herb.

Distinguishing the IDFxh1 from adjacent subzones/variants

In the **PPdh1** zonal sites have:	- bluebunch wheatgrass - less Fd, birch-leaved spirea, and tall Oregon-grape - no pinegrass
In the **IDFdm1** most sites have:	- Pl - more Lw
dry sites have:	- less arrow-leaved balsamroot and Idaho fescue

IDFun

Unit Summary

Undifferentiated Interior Douglas-fir (Windermere Lake) Unit

Location: Lower slopes and valley floor from the south end of Columbia Lake at Canal Flats north to Windermere Lake near Invermere. It also occurs up side drainages off the main valleys, especially on warm aspects.

This unit is small, poorly sampled, and consists primarily of private land. It was previously included with what is now the PPdh2. However, the IDFun (Windermere Lake) lacks Py.

Elevation range: 800 to 900 m.

Zonal vegetation: Zonal sites have open stands of Fd. There are practically no other tree species. Bluebunch wheatgrass and junegrass are the dominant understory species.

Distinguishing the IDF undifferentiated (Windermere Lake) from adjacent variants

In the IDFdm1 most sites have:	- Pl and Lw
zonal sites also have:	- no bluebunch wheatgrass or junegrass

IDFun

Unit Summary

Undifferentiated Interior Douglas-fir (Arrow Lake) Unit

Location: South- to west-facing lower slopes on the east side of Lower Arrow Lake from around Syringa Creek Park north to Broadwater. It also occurs along the warm aspects of Deer, Little Cayuse, Cayuse, Tulip, and Syringa Creeks which drain into the Lower Arrow Lake.

This unit is relatively small and has been poorly sampled. It was formerly included with the ICHxw. However, it has different vegetation from the ICHxw. This unit is most similar to the IDFmw1 which occurs in the Kamloops Region. Please refer to A Guide to Site Identification and Interpretation for the Kamloops Forest Region *(Lloyd* et al. *1990) for a complete description of the IDFmw1.*

Elevation range: 450 to 1000 m

Forest characteristics: Dry rocky sites are common in the IDFun (Arrow Lake). They are characterized by open mature climax stands of Py and Fd with bluebunch wheatgrass, ocean-spray, mock-orange, and mallow ninebark.

Distinguishing the IDFun (Arrow Lake) from adjacent subzones/variants

In the ICHdw zonal sites have:	- Cw and Bg - no climax Fd, snowberry, or pinegrass

IDFdm1

Variant Summary

Kettle Dry Mild Interior Douglas-fir Variant

Location: In the southern extremities of the Monashee Mountains, along valley bottoms and lower slopes. Predominantly in the Kettle and Granby river drainages. This variant is also found in the Kamloops Forest Region.

Elevation range: 500 to 1370 m (south aspect); 500 to 1280 m (north aspect).

Climate[20]: Dry Climatic Region; very hot, dry summers; cool winters with light snowfall. Soils generally dry out for long to short time periods during late summer. Snowpacks are very shallow and of short duration, allowing the soils to freeze to a shallow depth on some sites. On most sites, soil moisture deficits and cold air temperatures are major limitations to tree growth.

Soils, geology, and landforms: Common rock types in the Okanagan Highlands area of the IDFdm1 include quartzite, granodiorite, basalt, andesite, and argillite. In the Monashee Mountain areas of this variant, rock types include gneiss, schist, basalt, andesite, greenstone, and granodiorite. Mid to lower slopes have morainal soils with loamy to silty surface textures and glaciofluvial soils with sandy textures. Fluvial soils with loamy to sandy textures occur on lower to level slope positions. Morainal, glaciofluvial, and fluvial soils often have sandy textures at depth. Colluvial soils with loamy to silty surface textures occur on steep, upper slopes. Silty loess cappings are common is this variant.

Zonal vegetation: Climax zonal sites have closed-canopy stands of Fd. Mixed seral stands of Fd, Lw, and Pl are common. The understory is dominated by pinegrass with moderate cover of shrubs, such as birch-leaved spirea, soopolallie, and falsebox. Kinnikinnick and twinflower are also common.

Distinguishing the IDFdm1 from adjacent subzones/variants

In the **PPdh1** most sites have:	- no falsebox or common juniper - more cheatgrass, arrow-leaved balsamroot, narrow-leaved collomia, tall tumble-mustard, small-flowered blue-eyed Mary, junegrass, Kentucky bluegrass, common dandelion, and yellow salsify - less soopolallie, birch-leaved spirea, tall Oregon-grape, kinnikinnick, heart-leaved arnica, and trailing raspberry
zonal sites also have:	- no Pl, Lw, or pinegrass - less Fd
dry sites have:	- more compact selaginella
wet sites have:	- no Sxw, Cw, Utah honeysuckle, black twinberry, black gooseberry, thimbleberry, highbush-cranberry, or lady fern (These shrubs and herbs are also missing on mesic sites.)
In the **MSdm1** most sites have:	- more Bl, trapper's tea, black huckleberry, grouseberry, and heart-leaved twayblade - less Py and tall Oregon-grape
dry sites have:	- more cladonias
wet sites have:	- more queen's cup, one-leaved foamflower, and glow moss. (These species also occur with greater cover on mesic sites.)
In the **IDFxh1** most sites have:	- no Pl - more Idaho fescue - less Lw
zonal sites also have:	- more bluebunch wheatgrass and common snowberry
dry sites have:	- more arrow-leaved balsamroot
wet sites have:	- tufted clubrush and bluejoint - no Cw - more common snowberry

---

[20] Values for climate descriptors given in Appendix 12.

In the ICHmk1, most sites have:	- more Cw, Sitka alder, black huckleberry, queen's cup, and one-leaved foamflower - less Py
zonal sites also have:	- more Bl, Sxw, and red-stemmed feathermoss - less kinnikinnick
dry sites have:	- less bluebunch wheatgrass and junegrass
wet sites have:	- more bluejoint

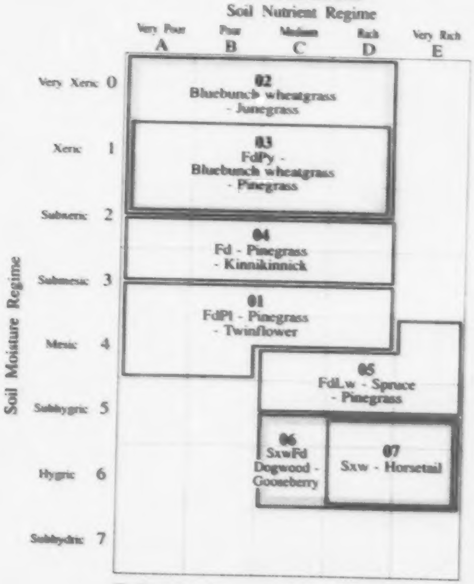
Forest characteristics: Frequent wildfires and extensive selective logging have left very few old- growth stands. Selective harvesting is the dominant method used in this variant. Clearcutting is not recommended unless forest health concerns exist.

Range characteristics: Grazing occurs on seeded cutblocks and other areas easily accessible to cattle. Grazing may have an impact on forest regeneration. Forest ingrowth reduces forage production at lower elevations. Noxious weeds are a problem.

Wildlife habitat: Fire's major role has resulted in stands with large, old Douglas-fir and ponderosa pine. Maintaining recurrent low intensity fires is key to wildlife protection. This variant supports a wide variety of species dependent on a mix of forest and grassland. The area is very important for populations of mule deer, white-tailed deer, elk, and bighorn sheep, which rely on it for winter range.

IDFdm1

Edatopic Grid


Soil Nutrient Regime
Very Poor A
Poor B
Medium C
Rich D
Very Rich E
Soil Moisture Regime
Very Xeric 0
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02 Bluebunch wheatgrass - Junegrass
03 FdPy - Bluebunch wheatgrass - Pinegrass
04 Fd - Pinegrass - Kinnikinnick
01 FdPl - Pinegrass - Twinflower
05 FdLw - Spruce - Pinegrass
06 SxwFd Dogwood - Gooseberry
07 Sxw - Horsetail

Shading used where considerable site series overlap occurs.

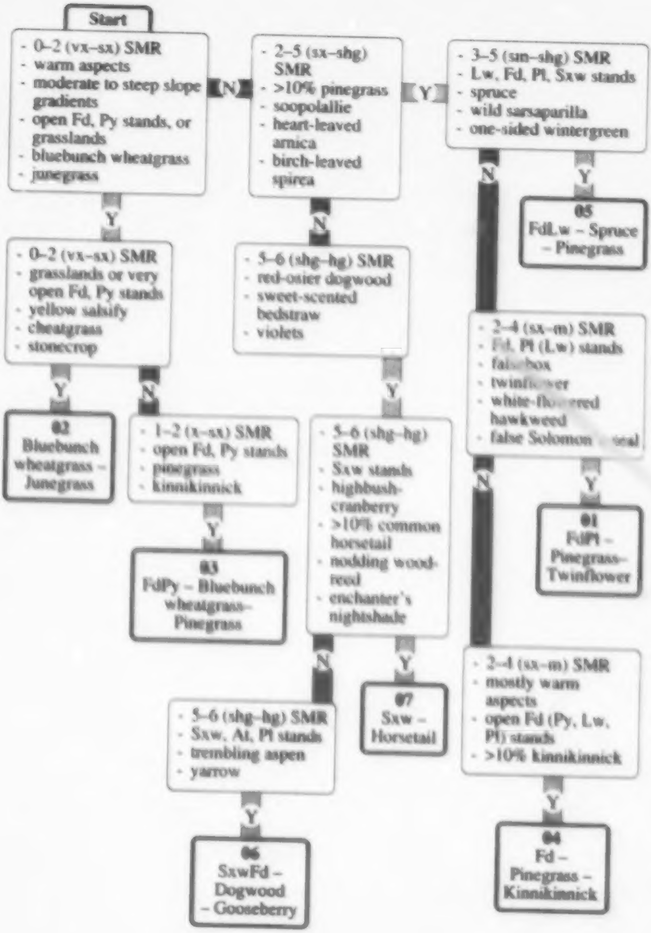
IDFdm1 Vegetation Table

	Site Series	02	03	04	01	05	06	07	
TREES	*Pinus ponderosa*	<1%	7 - 15%	1 - 7%		<1%			ponderosa pine
	Pseudotsuga menziesii	<1%	15 - 25%	>25%	>25%	15 - 25%	<1%		Douglas-fir
	Larix occidentalis			1 - 7%	7 - 15%	7 - 15%			western larch
	Pinus contorta			1 - 7%	15 - 25%	1 - 7%	1 - 7%	1 - 7%	lodgepole pine
	Picea glauca x engelmannii					7 - 15%	>25%	>25%	hybrid white spruce
SHRUBS	*Spiraea betulifolia*		<1%	1 - 7%	1 - 7%	1 - 7%			birch-leaved spirea
	Mahonia aquifolium		<1%	<1%	<1%	1 - 7%	<1%		tall Oregon-grape
	Juniperus communis				1 - 7%				common juniper
	Shepherdia canadensis			1 - 7%	1 - 7%	<1%			soopolallie
	Paxistima myrsinites			<1%	1 - 7%	1 - 7%			falsebox
	Amelanchier alnifolia	<1%	<1%	<1%	<1%	<1%	<1%	1 - 7%	saskatoon
	Symphoricarpos albus	<1%	7 - 15%	1 - 7%	<1%	1 - 7%	7 - 15%	1 - 7%	common snowberry
	Rubus parviflorus					1 - 7%	<1%	1 - 7%	thimbleberry
	Alnus crispa ssp. sinuata					<1%	1 - 7%	<1%	Sitka alder
	Ribes lacustre						<1%	<1%	black gooseberry
	Cornus stolonifera						15 - 25%	15 - 25%	red-osier dogwood
	Viburnum edule							<1%	highbush-cranberry
HERBS	*Sedum sp.*	1 - 7%							stonecrop
	Bromus tectorum	1 - 7%							cheatgrass
	Achillea millefolium	<1%							yarrow
	Agropyron spicatum	>25%	>25%						bluebunch wheatgrass
	Koeleria macrantha	1 - 7%	<1%						junegrass
	Lupinus sericeus		1 - 7%						silky lupine
	Arctostaphylos uva-ursi	<1%	15 - 25%	15 - 25%	1 - 7%				kinnikinnick
	Calamagrostis rubescens		7 - 15%	>25%	>25%	>25%	<1%		pinegrass
	Fragaria virginiana			<1%	<1%	<1%	<1%		wild strawberry
	Arnica cordifolia			<1%	<1%	1 - 7%			heart-leaved arnica
	Linnaea borealis				7 - 15%	7 - 15%	1 - 7%	1 - 7%	twinflower
	Cornus canadensis					1 - 7%	7 - 15%	7 - 15%	bunchberry
	Aralia nudicaulis					1 - 7%	1 - 7%	7 - 15%	wild sarsaparilla
	Thalictrum occidentale					<1%	<1%		western meadowrue
	Galium triflorum						<1%	<1%	sweet-scented bedstraw
	Equisetum arvense						<1%	>25%	common horsetail
	Gymnocarpium dryopteris						1 - 7%	7 - 15%	oak fern
	Athyrium filix-femina							1 - 7%	lady fern
	Cinna latifolia							<1%	nodding wood-reed
MOSSES AND	*Peltigera spp.*	<1%	1 - 7%	<1%	<1%				lichens
LICHENS	*Pleurozium schreberi*				1 - 7%	1 - 7%		<1%	red-stemmed feathermoss

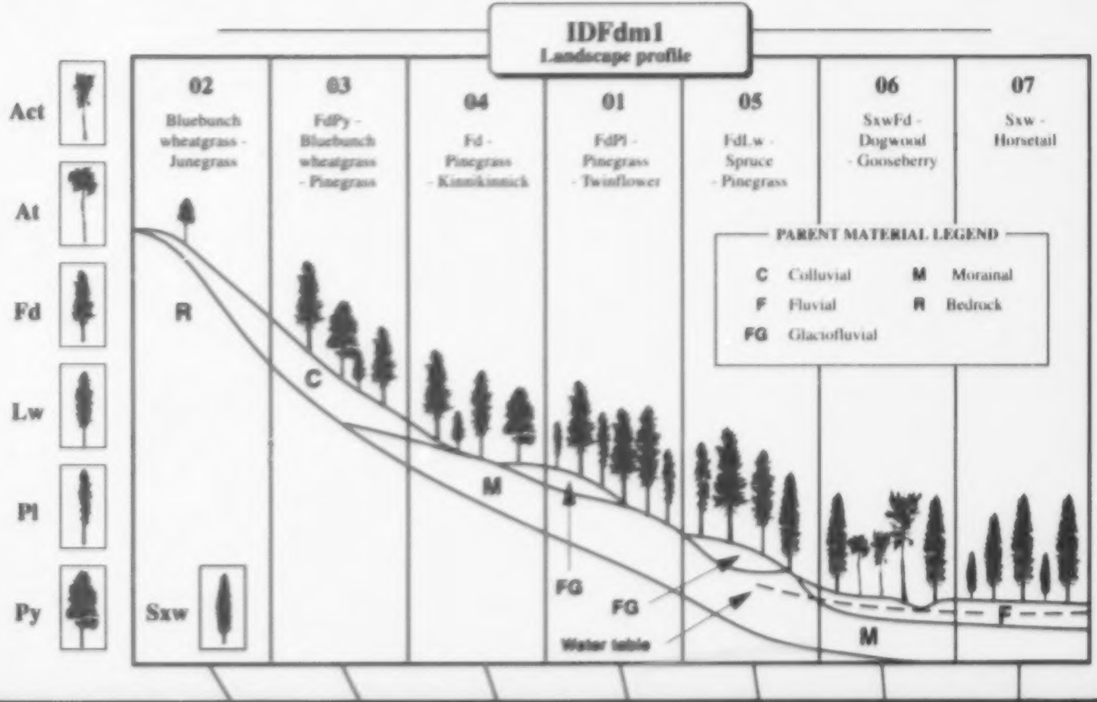
Approximate Cover Classes: ▭ <1% ▭ 1 - 7% ▭ 7 - 15% ▭ 15 - 25% ▭ >25%

IDFdm1

Site Series Flowchart


Start
- 0–2 (vx–sx) SMR
- warm aspects
- moderate to steep slope gradients
- open Fd, Py stands, or grasslands
- bluebunch wheatgrass
- junegrass
N
- 2–5 (sx–shg) SMR
- >10% pinegrass
- soopolallie
- heart-leaved arnica
- birch-leaved spirea
Y
- 3–5 (sm–shg) SMR
- Lw, Fd, Pl, Sxw stands
- spruce
- wild sarsaparilla
- one-sided wintergreen
Y
05
FdLw – Spruce – Pinegrass
N
Y
- 0–2 (vx–sx) SMR
- grasslands or very open Fd, Py stands
- yellow salsify
- cheatgrass
- stonecrop
N
- 5–6 (shg–hg) SMR
- red-osier dogwood
- sweet-scented bedstraw
- violets
- 2–4 (sx–m) SMR
- Fd, Pl (Lw) stands
- falsebox
- twinflower
- white-flowered hawkweed
- false Solomon's-seal
Y
02
Bluebunch wheatgrass – Junegrass
N
- 1–2 (x–sx) SMR
- open Fd, Py stands
- pinegrass
- kinnikinnick
Y
Y
- 5–6 (shg–hg) SMR
- Sxw stands
- highbush-cranberry
- >10% common horsetail
- nodding wood-reed
- enchanter's nightshade
N
Y
01
FdPl – Pinegrass– Twinflower
Y
03
FdPy – Bluebunch wheatgrass– Pinegrass
N
Y
07
Sxw – Horsetail
- 2–4 (sx–m) SMR
- mostly warm aspects
- open Fd (Py, Lw, Pl) stands
- >10% kinnikinnick
- 5–6 (shg–hg) SMR
- Sxw, At, Pl stands
- trembling aspen
- yarrow
Y
06
SxwFd – Dogwood – Gooseberry
Y
04
Fd – Pinegrass – Kinnikinnick

Y = Yes; N = No


IDFdm1
Landscape profile
Act
At
Fd
Lw
Pl
Py
Sxw
02
Bluebunch wheatgrass - Junegrass
03
FdPy - Bluebunch wheatgrass - Pinegrass
04
Fd - Pinegrass - Kinnikinnick
01
FdPl - Pinegrass - Twinflower
05
FdLw - Spruce - Pinegrass
06
SxwFd - Dogwood - Gooseberry
07
Sxw - Horsetail
PARENT MATERIAL LEGEND
C Colluvial
F Fluvial
FG Glaciofluvial
M Morainal
R Bedrock
R
C
M
FG
FG
Water table
M
F

IDFdm1 Environmental Table

Site series		**02**	**03**	**04**	**01**	**05**	**06**	**07**
Number of plots		10	5	33	18	17	9	4
Soil moisture regime[a] (SMR)		(0)[b]1-2 (vx)x-sx	1-2 x-sx	2-3(4) sx-sm(m)	(2)3-4 (sx)sm-m	(3)4-5 (sm)m-shg	5-6 shg-hg	5-6 shg-hg
Aspect		warm	warm	mostly warm	variable	variable	n.a.	n.a.
Slope gradient %		35-70	30-72	variable	variable	0-20	0	0
Slope position		crest-mid	upper-mid	variable	variable	lower-level	lower-level, depression	level
Parent material		C,FG	C	M,C,FG	M,FG	F,FG,M,C	F	F
Soil texture coarse fragments % (min.-**mean**-max.)	0-30 cm	L(S,C,S) 12-**41**-70	S(L) 0-**42**-75	L(S) 6-**33**-65	L(S) 16-**41**-67	L,S 0-**21**-55	L(S,S) 0-**11**-35	L 0-**5**-0
	30+ cm	L,S 15-**53**-75	S,L 0-**50**-99	L,S 13-**48**-80	S,L 40-**56**-70	S,L(C) 0-**35**-75	S,L(C) 0-**22**-55	S(L) 0-**11**-20
Humus form — LFH thickness cm (min.-**mean**-max.)		Mull (Moder, Mor) 0-**1**-3	Mull, Moder (Mor) 0.5-**2**-4	Mor (Moder) 1-**3.5**-9	Mor 1-**3.5**-9	Mor (Moder) 3-**5**-10	Moder, Mor 1-**9**-35	Mor, Moder, Mull 7-**15**-30
Important site features		restricting layer common	restricting layer common	restricting layer common, eolian veneers	—	some eolian veneers	water table 30-100 cm common	water table 30-100 cm common

[a] Environmental features contained in this table are defined in Section 3.4.4.

[b] Values in brackets less common.

IDFdm1

Management Interpretations[a]

Site series	Number of plots	Common seedling growth limiting factors[a,b]	Relative tree productivity		Vegetation potential - common complexes[c]	Road drainage control needs (see cautions[e])	Common site sensitivities (see cautions[d,e])	Other prescription considerations
			Gross volume productivity	Growth class (site index, tree species)				
02	10	Dry soil, Nutrients (on slopes >60%)	Non-forested or Very low	Poor (13, Fd)	Low - grass	Low	H displacement hazard on moderate slopes; H forest floor displacement hazard on all sites	No timber values; Conserve limited organic matter
03	5	Cold air temp., Dry soil, Nutrients (on slopes >60%)	Very low	Poor (13, Fd)	Low - grass	Low	H displacement hazard on steep slopes; H forest floor displacement hazard on all sites	Partial cutting recommended; Conserve limited organic matter
04	33	Cold air temp. (on flat sites), Dry soil, Nutrients	Low	Medium (18, Fd)	Low - pinegrass	Low	H displacement hazard on steep slopes; H forest floor displacement on all sites	Flat sites may be frost prone; Conserve limited organic matter

01	18	Dry soil, Cold air temp. (on flat sites), Nutrients (on sites with C.F. >30% or slope >30%)	Low	Medium (18, Fd)	Medium - pinegrass	Low	H forest floor displacement hazard on all sites	Flat sites may be frost prone; Conserve limited organic matter
05	17	Cold air temp. (on flat sites)	Medium	Medium (18, Fd)	Medium - pinegrass	Mod.	H compaction hazard on silty soils	Flat sites may be frost prone; Random machine travel on silty soils when dry or frozen soil; Riparian
06	9	Cold air temp., Nutrients (where water table <30cm)	Medium	Medium (18, Fd)	Medium - mixed shrub	Mod.		Frost prone sites; Windthrow hazard; Water table may rise post-harvest; Riparian
07	4	Cold air temp., Nutrients (where water table <30cm)	High	Medium (18, Fd)	Medium - mixed shrub	Mod.		Frost prone sites; Windthrow hazard; Water table may rise post-harvest; Riparian

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[a] **Caution:** Based on sample plot data; some interpretations expected to vary with individual site conditions. Use of original interpretive tools is necessary; these interpretations are presented here to "red flag" common concerns. This table outlines key considerations that should go into management decisions. Rationale and interpretive tools are discussed in Section 3.6.

[b] These include air temperature, soil temperature, vegetation, soil moisture, and soil nutrients; use of SYTEPREP recommended, see Section 3.6.1. C.F. = coarse fragments.

[c] Complexes described in Newton and Comeau (1990).

[d] **Caution:** This is presented here to "red flag" common drainage needs and is not intended to substitute for site specific engineering interpretations, see Section 3.6.4.

[e] **Caution:** Site sensitivity keys must be used with your site data for the PHSP; see Section 3.6.5. H = high, 30 - 45% = moderate slope, >45% = steep slope.

IDFdm2

Variant Summary

Kootenay Dry Mild Interior Douglas-fir Variant

Location: Valley bottoms and lower slopes of the Rocky Mountain Trench south of the Blaeberry River, and valley bottoms of major tributary valleys such as the Spillimacheen, Kootenay, Finlay, St. Mary, and Wigwam.

Elevation range: 800 to 1200 m (south aspect); 800 to 1100 m (north aspect).

Climate[21]**:** Dry Climatic Region; hot, very dry summers; cool winters with very light snowfall. Soils generally dry out for long to short time perids during late summer. Snowpacks are generally very shallow and of short duration, allowing soils to freeze to a shallow depth on some sites. Lack of soil moisture and frost are major limitations to tree growth on most sites.

Soils, geology, and landforms: Common rock types in the Rocky Mountain area of the IDFdm2 include limestone, calcareous shale, dolomite, quartzite, argillite, and sandstone. The Rocky Mountain Trench area of this variant is underlain by deep, recent sediments. In the Purcell Mountain area of this variant, bedrock consists of quartzite, argillite, limestone, siltstone, sandstone, conglomerate, quartz monzonite, and granite. Morainal soils with loamy or silty surface textures occur on lower to upper slopes. Glaciofluvial soils with loamy to clayey textures often occur in proximity to morainal soils. These soils often have strongly contrasting textures at depth. Silty eolian veneers cover many soils in this variant. Fluvial soils with loamy, silty, or clayey textures occur on lower to level slopes. Lacustrine soils with silty or clayey textures form level slopes with steeper terrace faces. Colluvial soils with loamy or sandy textures are found on upper slopes. Calcareous subsoils are common.

Zonal vegetation: Zonal sites have climax stands of Fd; however, mixed seral stands of Fd, Lw, and Pl are more common. The understory is dominated by pinegrass and a high cover of shrubs, such as birch-leaved spirea, common juniper, soopolallie, saskatoon, and common snowberry.

Distinguishing the IDFdm2 from adjacent subzones/variants

In the **MSdk** most sites have:	- no Py - more Sxw, Bl, false azalea, prince's pine, grouseberry, twinflower, red-stemmed feathermoss, and step moss
In the **ICHmk1** most sites have:	- Douglas maple, queen's cup, and one-leaved foamflower - no rough-fruited fairybells or northern bedstraw - more Bl, Cw, falsebox, thimbleberry, black huckleberry, prince's pine, rattlesnake-plantain, and red-stemmed feathermoss - less Py
zonal sites also have:	- no yarrow - less pinegrass
dry sites have:	- no cheatgrass - more cladonias - less junegrass
wet sites have:	- more black gooseberry - less trailing raspberry
In the **PPdh2** most sites have:	- shaggy fleabane - no Pl, Cw, Bl, Douglas maple, common juniper, tall Oregon-grape, or thimbleberry - more bluebunch wheatgrass - less heart-leaved arnica and asters

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[21] Values for climate descriptors given in Appendix 12.

zonal sites also have:
- prairie crocus and rosy pussytoes
- less pinegrass

wet sites have:
- no trailing raspberry, wild sarsaparilla, or sweet-scented bedstraw
- less common horsetail

In the IDFun (Windermere Lake), most sites have:
- bluebunch wheatgrass and junegrass
- no Pl or Lw

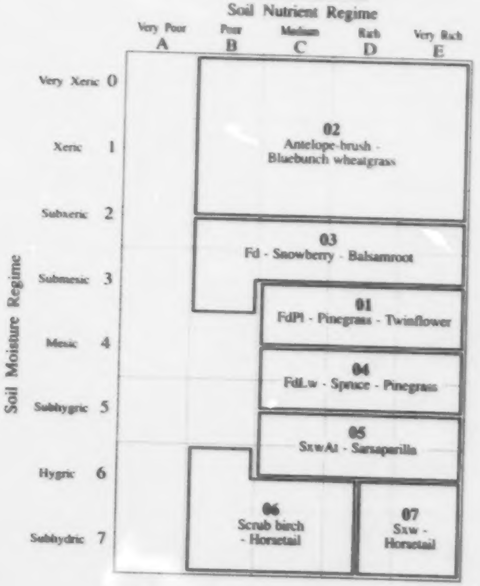
Forest characteristics: Frequent wildfires and extensive selective logging have left very few old-growth stands. After wildfire, Pl is common in seral stands. Mature stands consist of an open canopy of Fd with pinegrass in the understory.

Range characteristics: Grazing is mainly restricted to seeded cutblocks. Forest ingrowth reduces forage production at lower elevations. Noxious weeds are a problem.

Wildlife habitat: Fire's major role has resulted in stands with large, old Douglas-fir and ponderosa pine. Maintaining recurrent low intensity fires is key to wildlife protection. This variant supports a wide variety of species dependent on a mix of forest and grassland. The area is very important for large populations of mule deer, white-tailed deer, elk, and bighorn sheep, which rely on it for winter range. There is important waterfowl habitat along the Columbia River.

IDFdm2

Edatopic Grid



Soil Nutrient Regime
Very Poor A
Poor B
Medium C
Rich D
Very Rich E
Soil Moisture Regime
Very Xeric 0
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02 Antelope-brush - Bluebunch wheatgrass
03 Fd - Snowberry - Balsamroot
01 FdPl - Pinegrass - Twinflower
04 FdLw - Spruce - Pinegrass
05 SxwAt - Sarsaparilla
06 Scrub birch - Horsetail
07 Sxw - Horsetail

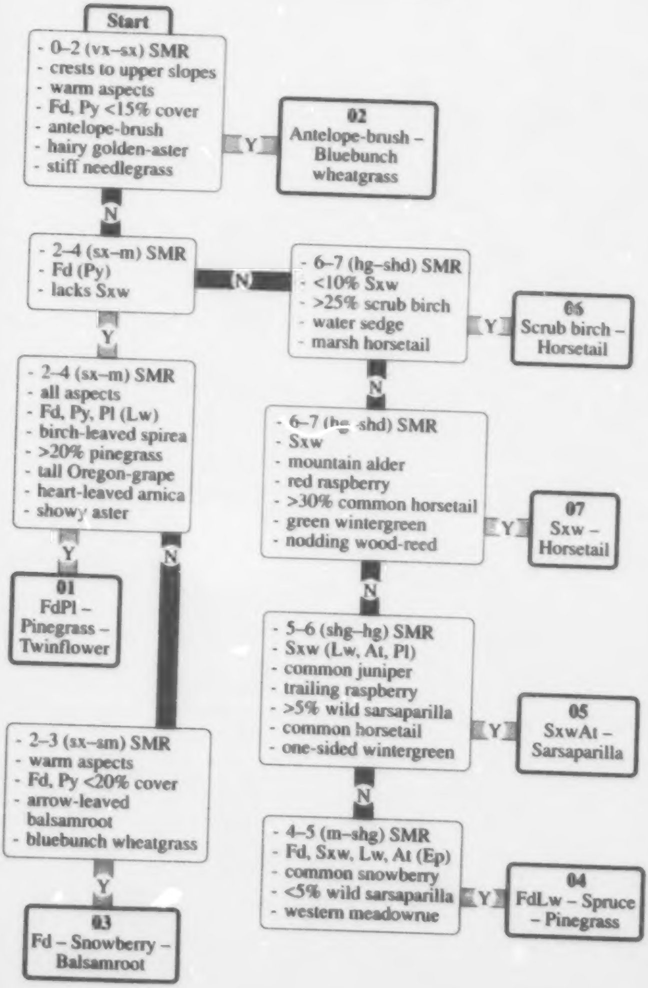
IDFdm2 Vegetation Table

	Site Series	02	03	01	04	05	06	07	
TREES	*Pinus ponderosa*	1 - 7%	1 - 7%	1 - 7%					ponderosa pine
	Pseudotsuga menziesii	7 - 15%	15 - 25%	15 - 25%	15 - 25%	<1%			Douglas-fir
	Pinus contorta			7 - 15%		1 - 7%			lodgepole pine
	Larix occidentalis			7 - 15%	7 - 15%	1 - 7%			western larch
	Populus tremuloides				15 - 25%	15 - 25%			trembling aspen
	Betula papyrifera				7 - 15%	1 - 7%		1 - 7%	paper birch
	Picea glauca x engelmannii				15 - 25%	15 - 25%	7 - 15%	>25%	hybrid white spruce
SHRUBS	*Purshia tridentata*	15 - 25%							antelope-brush
	Juniperus communis	<1%	1 - 7%	1 - 7%		<1%			common juniper
	Amelanchier alnifolia	15 - 25%	<1%	1 - 7%	1 - 7%	1 - 7%		<1%	saskatoon
	Shepherdia canadensis		1 - 7%	7 - 15%	1 - 7%				soopolallie
	Spiraea betulifolia			7 - 15%	1 - 7%	<1%			birch-leaved spirea
	Mahonia aquifolium			1 - 7%	7 - 15%	<1%			tall Oregon-grape
	Symphoricarpos albus		<1%	1 - 7%	15 - 25%	<1%	<1%	<1%	common snowberry
	Cornus stolonifera				<1%	1 - 7%	1 - 7%	15 - 25%	red-osier dogwood
	Betula glandulosa						>25%	<1%	scrub birch
	Potentilla fruticosa						7 - 15%		shrubby cinquefoil
	Alnus incana ssp. tenuifolia							7 - 15%	mountain alder
	Rubus idaeus							7 - 15%	red raspberry
HERBS	*Heterotheca villosa*	<1%							hairy golden-aster
	Arabis holboellii	<1%							Holboell's rockcress
	Achillea millefolium	<1%							yarrow
	Agropyron spicatum	15 - 25%	>25%						bluebunch wheatgrass
	Koeleria macrantha	1 - 7%	<1%						junegrass
	Arctostaphylos uva-ursi	<1%	7 - 15%	1 - 7%					kinnikinnick
	Balsamorhiza sagittata		7 - 15%						arrow-leaved balsamroot
	Calamagrostis rubescens		7 - 15%	>25%	7 - 15%				pinegrass
	Aster conspicuus			1 - 7%	1 - 7%				showy aster
	Aralia nudicaulis				1 - 7%	>25%		<1%	wild sarsaparilla
	Linnaea borealis			<1%	7 - 15%	<1%	<1%	<1%	twinflower
	Cornus canadensis				1 - 7%	7 - 15%		1 - 7%	bunchberry
	Pyrola chlorantha							<1%	green wintergreen
	Cinna latifolia							1 - 7%	nodding wood-reed
	Equisetum arvense							>25%	common horsetail
	Carex aquatilis						>25%		water sedge
	Equisetum palustre						>25%		marsh horsetail
MOSSES	*Mnium spp*							1 - 7%	leafy mosses
	Drepanocladus revolvens						>25%		moss
	Homalothecium nuttallii						>25%		moss

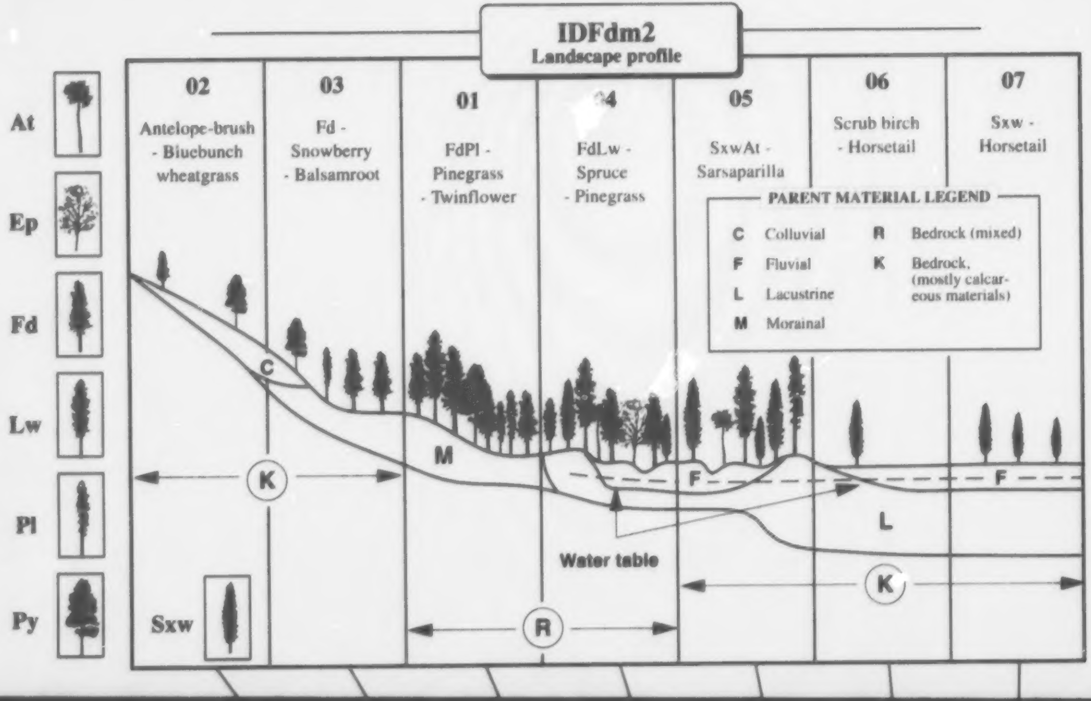
Approximate Cover Classes: ▭ <1% ▭ 1 - 7% ▭ 7 - 15% ▭ 15 - 25% ▭ >25%

IDFdm2

Site Series Flowchart


Start
- 0–2 (vx–sx) SMR
- crests to upper slopes
- warm aspects
- Fd, Py <15% cover
- antelope-brush
- hairy golden-aster
- stiff needlegrass
Y
02 Antelope-brush – Bluebunch wheatgrass
N
- 2–4 (sx–m) SMR
- Fd (Py)
- lacks Sxw
N
- 6–7 (hg–shd) SMR
- <10% Sxw
- >25% scrub birch
- water sedge
- marsh horsetail
Y
06 Scrub birch – Horsetail
Y
- 2–4 (sx–m) SMR
- all aspects
- Fd, Py, Pl (Lw)
- birch-leaved spirea
- >20% pinegrass
- tall Oregon-grape
- heart-leaved arnica
- showy aster
Y
01 FdPl – Pinegrass – Twinflower
N
N
- 6–7 (hg–shd) SMR
- Sxw
- mountain alder
- red raspberry
- >30% common horsetail
- green wintergreen
- nodding wood-reed
Y
07 Sxw – Horsetail
N
- 5–6 (shg–hg) SMR
- Sxw (Lw, At, Pl)
- common juniper
- trailing raspberry
- >5% wild sarsaparilla
- common horsetail
- one-sided wintergreen
Y
05 SxwAt – Sarsaparilla
- 2–3 (sx–sm) SMR
- warm aspects
- Fd, Py <20% cover
- arrow-leaved balsamroot
- bluebunch wheatgrass
Y
03 Fd – Snowberry – Balsamroot
N
- 4–5 (m–shg) SMR
- Fd, Sxw, Lw, At (Ep)
- common snowberry
- <5% wild sarsaparilla
- western meadowrue
Y
04 FdLw – Spruce – Pinegrass

Y = Yes; N = No



IDFdm2
Landscape profile

At
Ep
Fd
Lw
Pl
Py
02
Antelope-brush - Bluebunch wheatgrass
03
Fd - Snowberry - Balsamroot
01
FdPl - Pinegrass - Twinflower
04
FdLw - Spruce - Pinegrass
05
SxwAt - Sarsaparilla
06
Scrub birch - Horsetail
07
Sxw - Horsetail
PARENT MATERIAL LEGEND
C Colluvial
F Fluvial
L Lacustrine
M Morainal
R Bedrock (mixed)
K Bedrock, (mostly calcareous materials)
C
M
F
F
L
K
R
K
Water table
Sxw

IDFdm2 Environmental Table

Site series		02	03	01	04	05	06	07
Number of plots		3	13	26	10	5	1	3
Soil moisture regime[a] (SMR)		0-2 vx-sx	2-3 sx-sm	(2)[b]3-4 (sx)sm-m	4-5 m-shg	5-6 shg-hg	6-7 hg-shg	6-7 hg-shd
Aspect		warm	warm	variable	n.a.	n.a.	n.a.	n.a.
Slope gradient %		10-40	variable	0-45	0-15	0-3	flat	0-4
Slope position		crest-upper	upper-mid	variable	mid-lower, level	level	level	level, toe
Parent material		FG,C	M(C,FG)	M(FG)	L(F,M)	L,F	F	F
Soil texture coarse fragments % (min.-**mean**-max.)	0-30 cm	L(S) 0-**28**-58	L,$(C), 8-**29**-55	L,$(C) 0-**29**-68	$(C,L) 0-**1**-3	C$(L) 0-**7**-0	L 30-**30**-30	S(C) 0-**7**-20
	30+ cm	S,L 0-**35**-70	L(C) 15-**45**-80	C,L(S,$) 12-**40**-77	S,$,C,L 0-**16**-25	C,L($) 0-**10**-0	L 30-**30**-30	$ 0-**18**-35
Humus form — LFH thickness cm (min.-**mean**-max.)		Mull (Mor) 1-**1**-1	Mull, Mor 0-**2**-4	Mor 2-**4**-9	Mor (Moder) 3-**5**-11	Mor, Moder, Mull 2-**11**-23	Mor 4	Moder, Mor 4-**4.5**-5
Important site features		some restricting layers; calcareous	some restricting layers; calcareous; some eolian veneers; either chernozems or luvisols	some eolian and colluvial veneers	some eolian veneers; some restricting layers	some seepage; calcareous	seepage at or near surface; calcareous	seepage 35-70 cm; calcareous

[a] Environmental features contained in this table are defined in Section 3.4.4.

[b] Values in brackets less common.

IDFdm2

Management Interpretations[a]

Site series	Number of plots	**Common seedling growth limiting factors**[a,b]	**Relative tree productivity**		**Vegetation potential - common complexes**[c]	Road drainage control needs (see cautions[a,c])	**Common site sensitivities** (see cautions[a,e])	**Other prescription considerations**
			Gross volume productivity	Growth class (site index, tree species)				
02	3	Dry soil	Very low	Poor (15, Fd)	Low - grass	Low	-----	No timber values
03	13	Dry soil, Nutrients	Non-forested or Very low	Poor[f] (11, Fd)	Low - pinegrass	Low	H displacement hazard on steep slopes; H forest floor displacement hazard on all sites; H compaction hazard on silty soils	Partial cutting recommended; Conserve limited organic matter; Random machine travel on silty soils when dry or frozen
01	26	Cold air temp., Dry soil, Nutrients	Low	Medium (16, Fd)	Medium - pinegrass, dry shrub	Low	H forest floor displacement hazard on all sites; H compaction hazard on silty soils	Partial cutting recommended; Seedbanking species prolific after fire; Flat sites frost prone; Conserve limited organic matter; Random machine travel on silty soils when dry or frozen
04	10	Cold air temp., Wet soil	Low	Medium (19, Fd)	Medium - dry shrub, pinegrass	Mod.	H compaction hazard on silty soils	Seedbanking species prolific after fire; Flat sites frost prone; Random machine travel on frozen or dry soils

05	5	Cold air temp., Wet soil, Nutrients	Low	Good[f] (20, Fd)	Medium · mixed shrub	Mod.	H & VH compaction hazard on silty and clayey soils; H forest floor displacement hazard on clayey soils	Windthrow hazard; Water table may rise post-harvest; Frost prone sites; Conserve limited organic matter on clayey soils; Random machine travel on silty/clayey soils when frozen or dry; Riparian
06	1	Cold air temp., Wet soil, Nutrients (where water table <15 cm)	n.a.	n.a.	High · sedges	Mod.	H forest floor displacement hazard on all sites	No timber values; Riparian
07	3	Cold air temp., Wet soil, Nutrients	Low	Good[f] (20, Fd)	Medium · mixed shrub	Mod.	H compaction hazard on silty soils	Windthrow hazard; Water table may rise post-harvest; Frost prone sites; Random machine travel on silty soils when frozen; Riparian

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[a] **Caution:** Based on sample plot data; some interpretations expected to vary with individual site conditions. Use of original interpretive tools is necessary; these interpretations are presented here to "red flag" common concerns. This table outlines key considerations that should go into management decisions. Rationale and interpretive tools are discussed in Section 3.6.

[b] These include air temperature, soil temperature, vegetation, soil moisture, and soil nutrients; use of SYTEPREP recommended, see Section 3.6.1.

[c] Complexes described in Newton and Comeau (1990).

[d] **Caution:** This is presented here to "red flag" common drainage needs and is not intended to substitute for site specific engineering interpretations, see Section 3.6.4.

[e] **Caution:** Site sensitivity keys must be used with your site data for the PHSP; see Section 3.6.5. VH = very high, H = high, >45% = steep slope.

[f] Sample size less than five plots for site index determination.

MSdk

Subzone Summary

Dry Cool Montane Spruce Subzone

Location: Mid slopes in the Rocky Mountain Trench south of the Spillimacheen River; valley bottoms and lower slopes of valleys on the eastern flanks of the Purcell Mountains south of the Spillimacheen River; and valley bottoms and lower slopes in the Rocky Mountains south of the Kickinghorse River.

Elevation range: 1200 to 1650 m (south aspect); 1100 to 1550 m (north aspect).

Climate[22]**:** Dry Climatic Region; warm, dry summers; cold winters with light snowfall. Soils generally dry out for long to insignificant time periods during late summer. Snowpacks are generally shallow and of moderate duration. Soils may freeze to a shallow depth, or deeper if the soil is bladed. Lack of soil moisture and frost are major growth limiting factors.

Soils, geology, and landforms: Common rock types in the Rocky Mountain area of the MSdk include calcareous shale, limestone, dolomite, siltstone, sandstone, quartzite, and argillite. The Rocky Mountain Trench area of this subzone is underlain by recent sediments interrupted by bedrock hills of quartzite, argillite, limestone, sandstone, and shale. In the Purcell Mountain area of this subzone, bedrock includes quartzite, argillite, siltstone, limestone, granodiorite, and quartz monzonite. Fluvial soils with silty, loamy, or clayey surface textures occur on lower to level slopes. Morainal and glaciofluvial soils with loamy or silty textures occur on mid-slope to level valley bottoms. These soils often have strongly contrasting horizons at depth. Upper and steep slopes are covered by colluvial soils with silty or loamy textures. Lacustrine soils with silty or clayey textures occur on level slopes in valley bottoms. Loess cappings of silty texture are common. Organic soils are found on level and depressional sites. Root-restricting layers exist where bedrock, compact moraine, or cemented glaciofluvial layers are close to the surface. Soils with shallow calcareous horizons are common.

Zonal vegetation: Climax zonal sites have stands of Sxw and Bl with minor amounts of Fd. Seral stands of Pl are common. False azalea, Utah honeysuckle, and soopolallie are common shrubs. Grouseberry, twinflower, pinegrass, and heart-leaved arnica are common herbs.

Distinguishing the MSdk from adjoining subzones/variants

In the **IDFdm2** most sites have:	- no Bl - less false azalea, grouseberry, prince's pine, red-stemmed feathermoss, and step moss
zonal and drier sites also have:	- Py - no Sxw
In the ICHdw most sites have:	- Cw, Hw, Bg, black huckleberry, falsebox, and queen's cup - more Douglas maple - less grouseberry, showy aster, and pinegrass
wet sites have:	- devil's club, lady fern, and oak fern
In the ICHmw, most sites have:	- Cw, Hw, black huckleberry, falsebox, one-leaved foamflower, queen's cup, and pipecleaner moss - less grouseberry, wild strawberry, showy aster, heart-leaved arnica, and pinegrass

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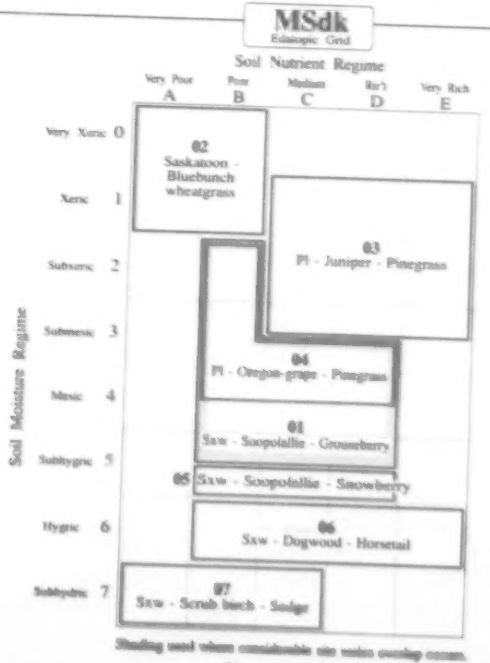
[22] Values for climate descriptors given in Appendix 12.

wet sites have:	- devil's club, lady fern, and oak fern
In the ICHmk1 most sites have:	- Cw, black huckleberry, and queen's cup - less prickly rose, heart-leaved arnica, and showy aster
wet sites have:	- devil's club and lady fern
In the ESSFdk most sites have:	- white-flowered rhododendron, black huckleberry, and Sitka valerian - more false azalea and grouseberry - less Lw and prickly rose
dry sites have:	- more nodding onion - less juniper haircap moss

Forest characteristics: Extensive stands of seral Pl exist in the MSdk because of widespread wildfires. The mountain pine beetle *(Dendroctonus ponderosae)* has devastated some areas, resulting in extensive salvage logging, especially in the Flathead River drainage.

The MSdk subzone is the most productive subzone in the Dry Climatic Region.

Wildlife habitat: The extensive fire history has maintained a predominance of early seral wildlife species. This subzone is important autumn and early winter range for deer, elk, moose, and bighorn sheep. This unit is also important habitat for grizzly bears. Remaining old-growth pockets are key to the maintenance of insect-feeding, cavity-nesting birds which aid in control of forest insect pests.



Shading used where considerable site series overlap occurs.

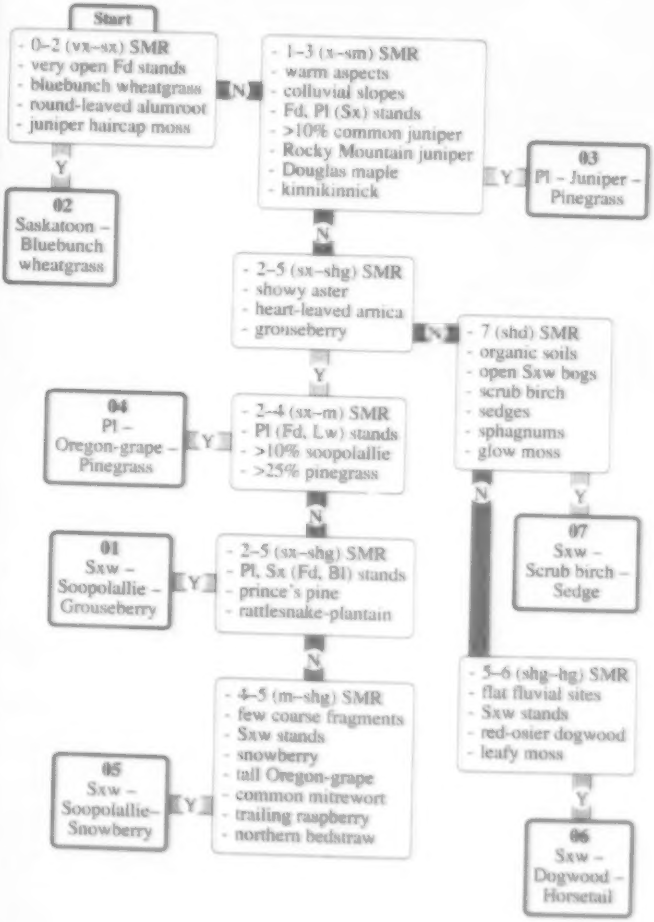
MSdk Vegetation Table

	Site Series	02	03	04	01	05	06	07	
TREES	*Pseudotsuga menziesii*	1 - 7%	15 - 25%	7 - 15%	7 - 15%	1 - 7%	<1%		Douglas-fir
	Pinus contorta		7 - 15%	>25%	15 - 25%	7 - 15%	<1%		lodgepole pine
	Larix occidentalis			1 - 7%	<1%	<1%			western larch
	Picea glauca x engelmannii		7 - 15%	1 - 7%	15 - 25%	>25%	>25%	7 - 15%	hybrid white spruce
	Abies lasiocarpa		<1%	<1%	7 - 15%	1 - 7%	1 - 7%		subalpine fir
SHRUBS	*Amelanchier alnifolia*	1 - 7%		<1%		<1%			saskatoon
	Acer glabrum	<1%	7 - 15%						Douglas maple
	Juniperus scopulorum		1 - 7%						Rocky Mountain juniper
	Juniperus communis		15 - 25%	<1%					common juniper
	Mahonia aquifolium			<1%					tall Oregon-grape
	Symphoricarpos albus	1 - 7%	<1%	<1%	<1%	7 - 15%			common snowberry
	Shepherdia canadensis		7 - 15%	15 - 25%	1 - 7%	1 - 7%			soopolallie
	Lonicera utahensis			<1%	1 - 7%	<1%			Utah honeysuckle
	Menziesia ferruginea		1 - 7%		7 - 15%	<1%	<1%		false azalea
	Lonicera involucrata				<1%	<1%	<1%		black twinberry
	Cornus stolonifera							1 - 7%	red-osier dogwood
	Betula glandulosa						<1%	>25%	scrub birch
	Ledum groenlandicum						1 - 7%	7 - 15%	Labrador tea
HERBS	*Agropyron spicatum*	15 - 25%							bluebunch wheatgrass
	Heuchera cylindrica	1 - 7%							round-leaved alumroot
	Arctostaphylos uva-ursi		7 - 15%	1 - 7%					kinnikinnick
	Linnaea borealis		1 - 7%	1 - 7%	1 - 7%	<1%	<1%		twinflower
	Calamagrostis rubescens		1 - 7%	>25%	1 - 7%	1 - 7%	<1%		pinegrass
	Aster conspicuus		<1%	1 - 7%	1 - 7%	1 - 7%			showy aster
	Arnica cordifolia			1 - 7%	1 - 7%	1 - 7%			heart-leaved arnica
	Vaccinium scoparium			1 - 7%	7 - 15%	1 - 7%	<1%		grouseberry
	Cornus canadensis			<1%	1 - 7%	7 - 15%	15 - 25%		bunchberry
	Thalictrum occidentale				1 - 7%	7 - 15%			western meadowrue
	Equisetum arvense					<1%	15 - 25%	7 - 15%	common horsetail
	Carex spp.						1 - 7%	>25%	sedges
	Petasites sagittatus							1 - 7%	arrow-leaved coltsfoot
MOSSES AND LICHENS	*Polytrichum juniperinum*	7 - 15%							juniper haircap moss
	Pleurozium schreberi		>25%	15 - 25%	>25%	15 - 25%	7 - 15%		red-stemmed feathermoss
	Hylocomium splendens		1 - 7%	<1%	7 - 15%	1 - 7%	7 - 15%		step moss
	Aulacomnium palustre							1 - 7%	glow moss
	Sphagnum capillaceum							>25%	common red sphagnum

Approximate Cover Classes: ▭ <1% ▭ 1 - 7% ▭ 7 - 15% ▭ 15 - 25% ▭ >25%

MSdk

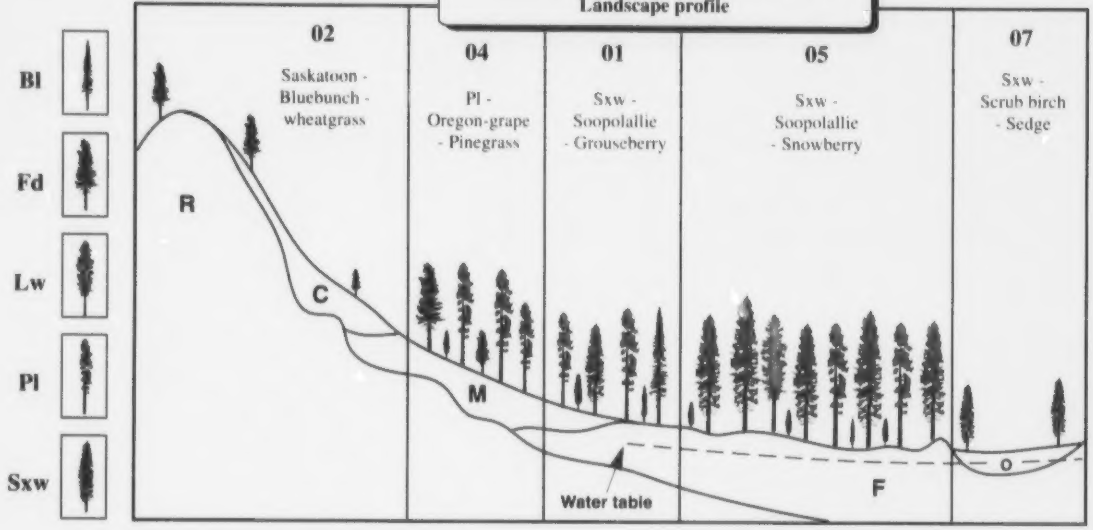
Site Series Flowchart


Start
- 0–2 (vx–sx) SMR
- very open Fd stands
- bluebunch wheatgrass
- round-leaved alumroot
- juniper haircap moss
Y
02
Saskatoon – Bluebunch wheatgrass
N
- 1–3 (x–sm) SMR
- warm aspects
- colluvial slopes
- Fd, Pl (Sx) stands
- >10% common juniper
- Rocky Mountain juniper
- Douglas maple
- kinnikinnick
Y
03
Pl – Juniper – Pinegrass
N
- 2–5 (sx–shg) SMR
- showy aster
- heart-leaved arnica
- grouseberry
Y
- 2–4 (sx–m) SMR
- Pl (Fd, Lw) stands
- >10% soopolallie
- >25% pinegrass
Y
04
Pl – Oregon-grape – Pinegrass
N
- 2–5 (sx–shg) SMR
- Pl, Sx (Fd, Bl) stands
- prince's pine
- rattlesnake-plantain
Y
01
Sxw – Soopolallie – Grouseberry
N
- 4–5 (m–shg) SMR
- few coarse fragments
- Sxw stands
- snowberry
- tall Oregon-grape
- common mitrewort
- trailing raspberry
- northern bedstraw
Y
05
Sxw – Soopolallie– Snowberry
N
- 7 (shd) SMR
- organic soils
- open Sxw bogs
- scrub birch
- sedges
- sphagnums
- glow moss
Y
07
Sxw – Scrub birch – Sedge
N
- 5–6 (shg–hg) SMR
- flat fluvial sites
- Sxw stands
- red-osier dogwood
- leafy moss
Y
06
Sxw – Dogwood – Horsetail

Y = Yes; N = No

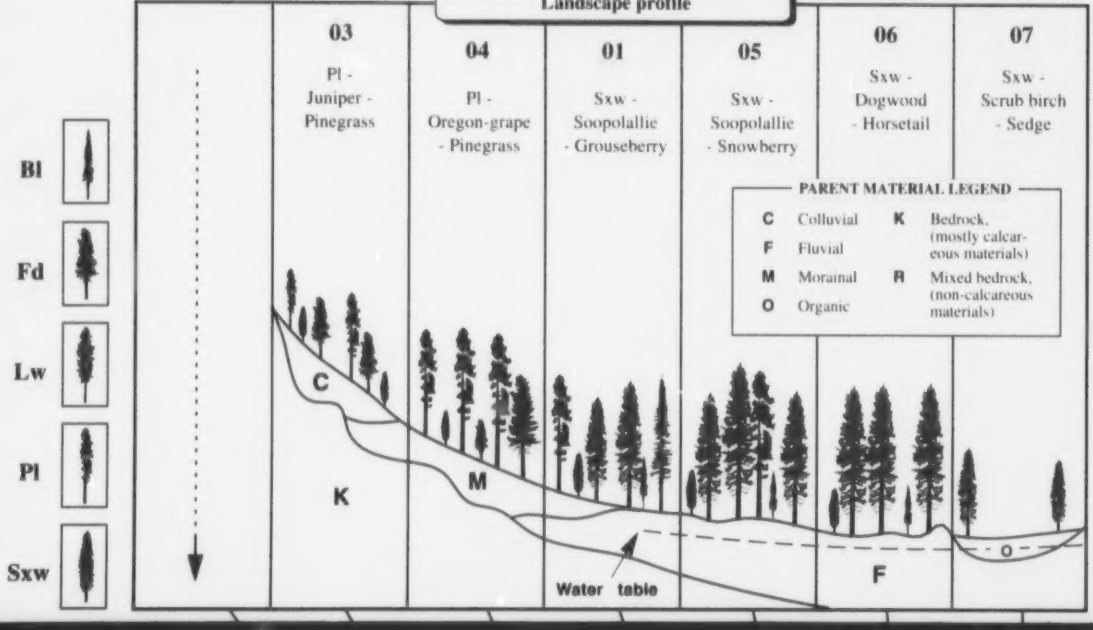
MSdk (non-calcareous bedrock)

Landscape profile


Bl
Fd
Lw
Pl
Sxw
02
Saskatoon - Bluebunch - wheatgrass
04
Pl - Oregon-grape - Pinegrass
01
Sxw - Soopolallie - Grouseberry
05
Sxw - Soopolallie - Snowberry
07
Sxw - Scrub birch - Sedge
R
C
M
F
O
Water table

MSdk (calcareous bedrock)

Landscape profile


Bl
Fd
Lw
Pl
Sxw
03
Pl - Juniper - Pinegrass
04
Pl - Oregon-grape - Pinegrass
01
Sxw - Soopolallie - Grouseberry
05
Sxw - Soopolallie - Snowberry
06
Sxw - Dogwood - Horsetail
07
Sxw - Scrub birch - Sedge
PARENT MATERIAL LEGEND
C Colluvial
F Fluvial
M Morainal
O Organic
K Bedrock, (mostly calcareous materials)
R Mixed bedrock, (non-calcareous materials)
C
K
M
F
O
Water table

MSdk Environmental Table

Site series		02	03	04	01	05	06	07
Number of plots		3	9	31	52	15	11	5
Soil moisture regime[a] (SMR)		0-2 vx-sx	1-3 x-sm	2-4 sx-m	2-5 sx-shg	(4)[b]-5 (m)-shg	5-6 shg-hg	7 shd
Aspect		variable	warm	variable	variable	n.a.	n.a.	n.a.
Slope gradient %		30-60	30-60	variable	0-30	0-11	0-4	0-2
Slope position		crest	variable	mid, lower, level	mid, lower, level	lower, level	level	level
Parent material		C	C	M,FG	F,FG,M	F,L	F(FG,O)	O
Soil texture coarse fragments % (min-**mean**-max.)	0-30 cm	$ 20-**38**-53	$(L,S) 38-**62**-95	L,$(C,S) 1-**26**-45	L,$(C) 4-**27**-55	$,C,L 0-**12**-33	$(L) 0-**10**-35	organic (C) 0
	30+ cm	L 62-**62**-62	$(S,L,C) 55-**73**-90	S,C(L,$) 4-**46**-78	L,C,$(S) 22-**52**-77	C($,S,L) 0-**21**-47	$,L(C,S) 0-**22**-53	organic (C) 0
Humus form — LFH thickness cm (min.-**mean**-max.)		Mull, Moder 1-**5**-10	variable 1-**6**-19	Mor 2-**5**-10	Mor 2-**8**-25	Mor **4-7**-13	Mor 1-**10**-31	Mor 10-**17**-24
Important site features		restricting layers common; non-calcareous	calcareous; mossy on cool aspects	restricting layers common	some restricting layers	—	calcareous	—

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[a] Environmental features contained in this table are defined in Section 3.4.4.

[b] Values in brackets less common.

MSdk

Management Interpretations[a]

Site series	Number of plots	Common seedling growth limiting factors[a,b]	Relative tree productivity		Vegetation potential - common complexes[c]	Road drainage control needs (see cautions[a,c])	Common site sensitivities (see cautions[a,e])	Other prescription considerations
			Gross volume productivity	Growth class (site index, tree species)				
02	3	Dry soil, Cold soil	None to Very low	Poor[f] (15, Fd)	Low - grass	Low	H displacement hazard on moderate slopes	No timber values
03	9	Dry soil, Nutrients	Low	Medium[f] (17, Fd)	Low - dry shrub	Mod.	H forest floor displacement on all sites; H displacement hazard on moderate slopes	Partial cutting recommended; Conserve limited organic matter
04	31	Cold air temp., Dry soil, Cold soil, Nutrients	Low	Medium (16, Fd)	Low - pinegrass	Mod.	H forest floor displacement hazard on all sites; H displacement and mass wasting hazards on steep slopes; H surface erosion hazard on moderate slopes; H compaction hazard on silty soils	Conserve limited organic matter; Special road construction/maintenance on steep slopes; Random machine travel on silty soils when dry or on snowpack

01	52	Cold air temp., Cold soil	Med.	Medium (19, Fd)	Medium - mixed shrub, fireweed, dry alder	High	H compaction hazard on silty soils	Random machine travel on silty soils when dry or on snowpack
05	15	Cold air temp., Cold soil, Nutrients (on clay soils)	Med.	Good[f] (23, Fd)	Medium - mixed shrub, fireweed	High	H-VH compaction hazard on silty and clayey soils; H forest floor displacement hazard on clayey soils	Conserve organic material on clayey soils; Random machine travel on clayey soils on snowpack
06	11	Cold air temp., Cold soil	Med.	Good[f] (21, Fd)	Medium - mixed shrub, fireweed	High	H compaction hazard on silty soils	Windthrow hazard; Water table may rise post harvest; Random machine travel on silty soils on snowpack; Riparian
07	5	Wet soil, Cold soil, Cold air temp.	None or Very low	No data	Medium - sedge	High	H compaction and displacement hazards on organic soils	Nonforested fen and bogs; No timber values; Riparian

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[a] **Caution**: Based on sample plot data; some interpretations expected to vary with individual site conditions. Use of original interpretive tools is necessary; these interpretations are presented here to "red flag" common concerns. This table outlines key considerations that should go into management decisions. Rationale and interpretive tools are discussed in Section 3.6.

[b] These include air temperature, soil temperature, vegetation, soil moisture, and soil nutrients; use of SYTEPREP recommended, see Section 3.6.1.

[c] Complexes described in Newton and Comeau (1990).

[d] **Caution**: This is presented here to "red flag" common drainage needs and is not intended to substitute for site specific engineering interpretations, see Section 3.6.4.

[e] **Caution**: Site sensitivity keys must be used with your site data for the PHSP; see Section 3.6.5. VH = very high, H = high, 30 - 45% = moderate slope, >45% = steep slope.

[f] Sample size less than five plots for site index determination.

MSdm1

Variant Summary

Okanagan Dry Mild Montane Spruce Variant

Location: Mid slopes in the Okanagan Highlands and in the Midway Range of the Monashee Mountains. This variant is also found in the Kamloops Forest Region.

Elevation range: 1370 to 1650 m (south aspect); 1280 to 1550 m (north aspect).

Climate[22]**:** Dry Climatic Region; warm, dry summers; cold winters with light snowfall. Soils generally dry out for long to insignificant time periods during late summer. Snowpacks are generally shallow and of moderate duration. This prevents soils from freezing to a significant depth unless the soil is bladed. Lack of soil moisture and frequent frost limit tree growth.

Soils, geology, and landforms: Common rock types in the MSdm1 include granodiorite, andesite, argillite, quartzite, limestone, conglomerate, and basalt. Morainal soils with loamy surface textures and glaciofluvial soils with sandy textures occur on upper to lower slopes. Sandy textured fluvial deposits occur on level and toe slope positions. Morainal, glaciofluvial, and fluvial soils often have sandy textures at depth. Some areas have silty loess cappings. Minor areas of loamy textured colluvial soils are found on steeper slopes. Calcareous soils can be expected where local bedrock includes limestone.

Zonal vegetation: Climax zonal sites have stands of Sxw and Bl. Understory shrubs are primarily falsebox, black huckleberry, and Utah honeysuckle. Herbs include grouseberry, pinegrass, twinflower, queen's cup, and bunchberry. Red-stemmed feathermoss is common.

Distinguishing the MSdm1 from adjacent subzones/variants

In the ESSFdc1 most sites have:	- no Fd, Lw - more Sitka valerian - less Sitka alder, soopolallie, prince's pine, bunchberry, and rattlesnake-plantain
zonal sites also have:	- white-flowered rhododendron
dry sites have:	- no saskatoon, common snowberry, or yarrow - less kinnikinnick
wet sites have:	- no highbush-cranberry, lady fern, oak fern, or baneberry - less sweet-scented bedstraw, palmate coltsfoot and pink wintergreen
In the ICHmk1 most sites have:	- more Douglas maple - less heart-leaved arnica and grouseberry
zonal sites have:	- Cw
dry sites have:	- more racemose pussytoes
wet sites have:	- less glow moss and trapper's tea
In the IDFdm1 most sites have:	- Py - no Bl or Sxw - more tall Oregon-grape - less black huckleberry and grouseberry

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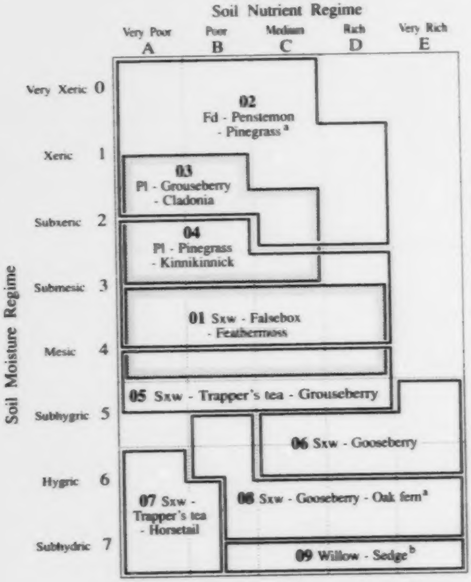
[22] Values for climate descriptors given in Appendix 12.

dry sites have:	- less cladonias
wet sites have:	- less trapper's tea, one-leaved foamflower, queen's cup, heart-leaved twayblade, and glow moss

Forest characteristics: An extensive history of wildfires has led to a predominance of Pl stands and few climax stands. Mountain pine beetle infestations are widespread. Extensive clearcutting has resulted in a "fragmented" forest in many areas of the MSdm1.

Wildlife habitat: The extensive fire history has maintained many early seral wildlife species. This subzone is important late fall range for deer, elk, and bighorn sheep and winter range for moose. South and west aspects are potential winter range for mule deer. Remaining old-growth pockets are key to the maintenance of insect-feeding cavity-nesting birds which aid in control of forest insect pests.

MSdm1
Edatopic Grid


Soil Nutrient Regime
Very Poor A
Poor B
Medium C
Rich D
Very Rich E
Soil Moisture Regime
Very Xeric 0
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02 Fd - Penstemon - Pinegrass [a]
03 Pl - Grouseberry - Cladonia
04 Pl - Pinegrass - Kinnikinnick
01 Sxw - Falsebox - Feathermoss
05 Sxw - Trapper's tea - Grouseberry
06 Sxw - Gooseberry
07 Sxw - Trapper's tea - Horsetail
08 Sxw - Gooseberry - Oak fern [a]
09 Willow - Sedge [b]

Shading used where considerable site series overlap occurs.

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[a] 02 Fd - Penstemon - Pinegrass and 08 Sxw - Gooseberry - Oak fern not recognized in Lloyd *et al.* (1990)

[b] 09 Willow - Sedge numbered 08 in Lloyd *et al.* (1990)

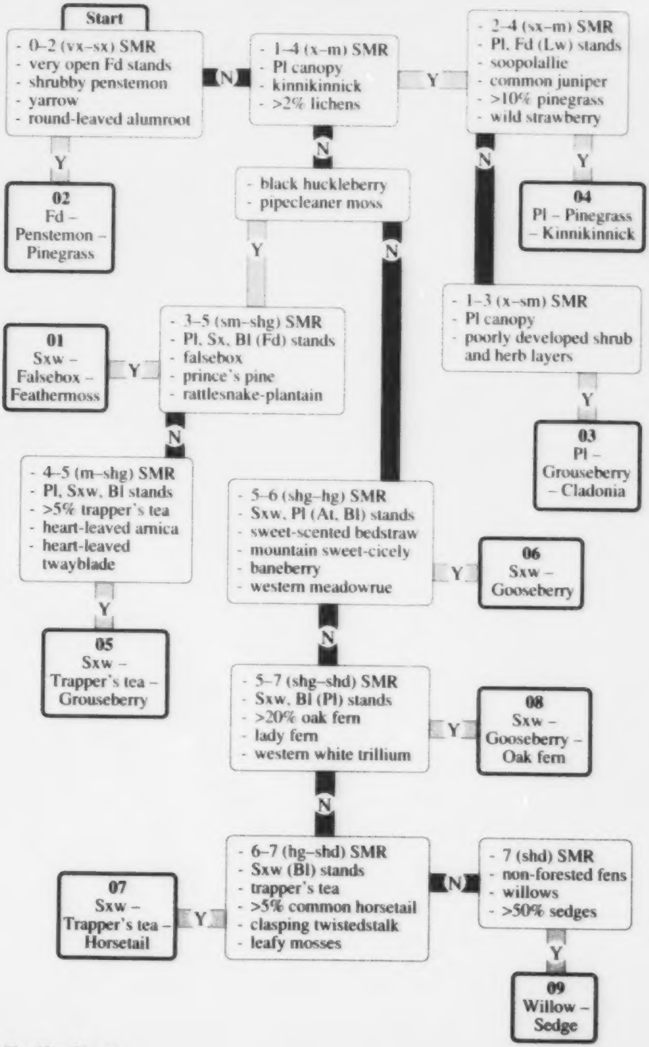
MSdm1 Vegetation Table

	Site Series	02	03	04	01	05	06	07	08	09	
TREES	*Pseudotsuga menziesii*	15 - 25%	<1%	15 - 25%	1 - 7%		1 - 7%				Douglas-fir
	Larix occidentalis			<1%	<1%						western larch
	Pinus contorta		>25%	>25%	15 - 25%	>25%	15 - 25%		1 - 7%		lodgepole pine
	Picea engelmannii x glauca		<1%	<1%	15 - 25%	15 - 25%	>25%	>25%	>25%		hybrid white spruce
	Abies lasiocarpa		1 - 7%		15 - 25%	15 - 25%	7 - 15%	15 - 25%	15 - 25%		subalpine fir
SHRUBS	*Penstemon fruticosus*	<1%									shrubby penstemon
	Juniperus communis	1 - 7%		1 - 7%							common juniper
	Paxistima myrsinites	1 - 7%	1 - 7%	1 - 7%	15 - 25%	1 - 7%					falsebox
	Shepherdia canadensis			1 - 7%							soopolallie
	Lonicera utahensis		<1%	<1%	1 - 7%	1 - 7%	<1%	1 - 7%			Utah honeysuckle
	Spiraea betulifolia	1 - 7%	<1%	1 - 7%	<1%				<1%		birch-leaved spirea
	Vaccinium membranaceum				7 - 15%	1 - 7%	<1%		1 - 7%		black huckleberry
	Alnus crispa ssp. *sinuata*				1 - 7%	1 - 7%	1 - 7%	1 - 7%	1 - 7%		Sitka alder
	Lonicera involucrata					<1%	<1%	1 - 7%	<1%		black twinberry
	Ledum glandulosum					>25%		15 - 25%			trapper's tea
	Rubus parviflorus				<1%		1 - 7%		1 - 7%		thimbleberry
	Ribes lacustre				<1%	1 - 7%	7 - 15%	1 - 7%	7 - 15%		black gooseberry
	Salix spp.									15 - 25%	willows
HERBS	*Achillea millefolium*	<1%									yarrow
	Arctostaphylos uva-ursi	1 - 7%	15 - 25%	15 - 25%							kinnikinnick
	Calamagrostis rubescens	15 - 25%	<1%	>25%	1 - 7%	<1%					pinegrass
	Vaccinium scoparium		7 - 15%	15 - 25%	7 - 15%	>25%	<1%	7 - 15%			grouseberry
	Linnaea borealis		1 - 7%	7 - 15%	1 - 7%	<1%	<1%	<1%			twinflower
	Cornus canadensis			<1%	1 - 7%	1 - 7%	1 - 7%	1 - 7%	1 - 7%		bunchberry
	Orthilia secunda				<1%	1 - 7%	<1%		<1%		one-sided wintergreen
	Clintonia uniflora				1 - 7%	1 - 7%	<1%	<1%	7 - 15%		queen's cup
	Tiarella trifoliata var. *unifoliata*				<1%	1 - 7%	<1%	1 - 7%	7 - 15%		one-leaved foamflower
	Rubus pedatus				<1%	7 - 15%	<1%	1 - 7%	7 - 15%		five-leaved bramble
	Osmorhiza chilensis						<1%				mountain sweet-cicely
	Galium triflorum						1 - 7%		<1%		sweet-scented bedstraw
	Athyrium filix-femina							7 - 15%	15 - 25%		lady fern
	Gymnocarpium dryopteris							1 - 7%	>25%		oak fern
	Equisetum spp.							>25%	<1%		horsetails
	Carex spp.			<1%	<1%			1 - 7%		>25%	sedges
MOSSES AND LICHENS	*Cladonia* spp.	1 - 7%	15 - 25%	1 - 7%	<1%	<1%		<1%			cladonias
	Peltigera spp.	<1%	<1%	1 - 7%	<1%		<1%				lichens
	Pleurozium schreberi		<1%	<1%	15 - 25%	>25%	1 - 7%	1 - 7%	<1%		red-stemmed feathermoss
	Mnium spp.						<1%	>25%	15 - 25%		leafy mosses
	Aulacomnium palustre					<1%		7 - 15%		15 - 25%	glow moss

Approximate Cover Classes: <1% 1 - 7% 7 - 15% 15 - 25% >25%

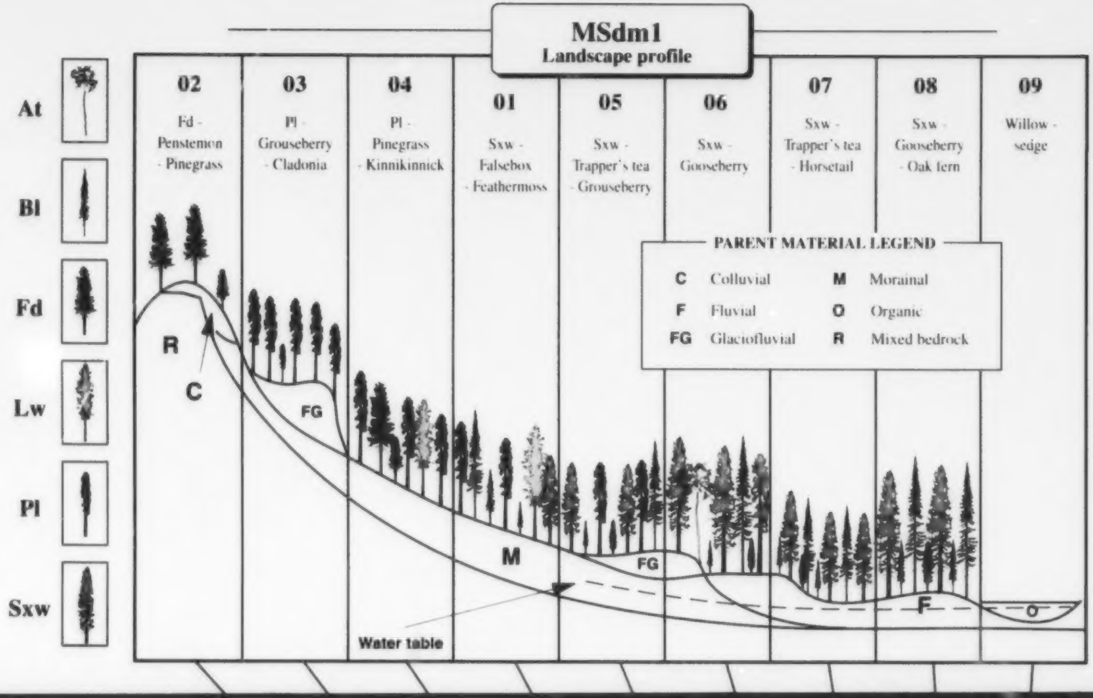
MSdm1

Site Series Flowchart


Start
- 0–2 (vx–sx) SMR
- very open Fd stands
- shrubby penstemon
- yarrow
- round-leaved alumroot
N
- 1–4 (x–m) SMR
- Pl canopy
- kinnikinnick
- >2% lichens
Y
- 2–4 (sx–m) SMR
- Pl, Fd (Lw) stands
- soopolallie
- common juniper
- >10% pinegrass
- wild strawberry
Y
02 Fd – Penstemon – Pinegrass
N
- black huckleberry
- pipecleaner moss
N
Y
04 Pl – Pinegrass – Kinnikinnick
Y
N
- 1–3 (x–sm) SMR
- Pl canopy
- poorly developed shrub and herb layers
Y
03 Pl – Grouseberry – Cladonia
01 Sxw – Falsebox – Feathermoss
Y
- 3–5 (sm–shg) SMR
- Pl, Sx, Bl (Fd) stands
- falsebox
- prince's pine
- rattlesnake-plantain
N
- 4–5 (m–shg) SMR
- Pl, Sxw, Bl stands
- >5% trapper's tea
- heart-leaved arnica
- heart-leaved twayblade
Y
05 Sxw – Trapper's tea – Grouseberry
- 5–6 (shg–hg) SMR
- Sxw, Pl (At, Bl) stands
- sweet-scented bedstraw
- mountain sweet-cicely
- baneberry
- western meadowrue
Y
06 Sxw – Gooseberry
N
- 5–7 (shg–shd) SMR
- Sxw, Bl (Pl) stands
- >20% oak fern
- lady fern
- western white trillium
Y
08 Sxw – Gooseberry – Oak fern
N
- 6–7 (hg–shd) SMR
- Sxw (Bl) stands
- trapper's tea
- >5% common horsetail
- clasping twistedstalk
- leafy mosses
Y
07 Sxw – Trapper's tea – Horsetail
N
- 7 (shd) SMR
- non-forested fens
- willows
- >50% sedges
Y
09 Willow – Sedge

Y = Yes; N = No

MSdm1
Landscape profile


At
Bl
Fd
Lw
Pl
Sxw
02
Fd - Penstemon - Pinegrass
03
Pl - Grouseberry - Cladonia
04
Pl - Pinegrass - Kinnikinnick
01
Sxw - Falsebox - Feathermoss
05
Sxw - Trapper's tea - Grouseberry
06
Sxw - Gooseberry
07
Sxw - Trapper's tea - Horsetail
08
Sxw - Gooseberry - Oak fern
09
Willow - sedge
PARENT MATERIAL LEGEND
C Colluvial
F Fluvial
FG Glaciofluvial
M Morainal
O Organic
R Mixed bedrock
R
C
FG
M
FG
F
O
Water table

MSdm1 Environmental Table

Site series		02	03	04	01	05	06	07	08	09
Number of plots		10	6	32	34	15	20	7	10	4
Soil moisture regime[a] (SMR)		0-2 vx-sx	1-3 x-sm	2-4 sx-m	3-4(5)[b] sm-m(shg)	4-5 m-shg	5-6 shg-hg	6-7 hg-shd	5-7 shg-shd	7 shd
Aspect		warm	variable	variable	variable	n.a.	n.a. (or cool)	n.a.	n.a.	n.a.
Slope gradient %		variable	0-25	0-40	0-35	0-15	0-25	0-10	0-15	0
Slope position		crest-upper	crest, level	crest-mid, level	upper-lower	mid-toe	mid-toe, level	lower-toe (depression)	lower-toe	lower, level, depression
Parent material		C,M	FG,F	M,FG	M,F,FG	M,FG	F,M(FG)	F	F(M)	O
Soil texture coarse fragments % (min.-**mean**-max.)	0-30 cm	L(S) 40-**57**-65	L(S) 13-**35**-60	L(S) 20-**35**-53	L($) 10-**23**-40	L(S) 30-**45**-60	L(S,$,C) 0-**36**-78	L($) 0-**23**-30	L(C,S,$) 5-**19**-30	organic
	30+ cm	L(S) 53-**67**-85	S,L 45-**53**-60	S,L 38-**53**-70	S(L) 25-**42**-65	S,L($) 40-**55**-70	S(L) 15-**47**-80	S,L($) 0-**26**-30	L,S($) 15-**36**-70	organic
Humus form — LFH thickness cm (min.-**mean**-max.)		Mor, (Moder) 0-**2**-5	Mor 1-**3**-5	Mor 1-**3**-8	Mor, (Moder) 3-**6**-12	Mor 0-**7**-15	Mor, (Moder) 2-**8**-15	Mor 0-**23**-50	Mor 6-**10**-21	organic soil
Important site features		restricting layers common	—	—	some eolian veneers	some seepage; soil mottled	seepage 30-100 cm	water table 0-50 cm deep; organic veneers	water table 10-100 cm, organic veneers	water table 0-5 cm deep

[a] Environmental features contained in this table are defined in Section 3.4.4.

[b] Values in brackets less common.

MSdm1

Management Interpretations[a]

Site series	Number of plots	Common seedling growth limiting factors[a,b]	Relative tree productivity		Vegetation potential - common complexes[c]	Road drainage control needs (see cautions[a,e])	Common site sensitivities (see cautions[a,e])	Other prescription considerations[f]
			Gross volume productivity	Growth class (site index, tree species)				
02	10	Dry soil, Nutrients	Very Low	Poor[f] (14, Fd)	Low - pinegrass	Low	H forest floor displacement hazard on all sites; H displacement hazard on moderate slopes; H surface erosion hazard on very steep slopes	Partial cutting recommended; Conserve limited organic matter
03	6	Cold air temp. Dry soil, Cold soil, Nutrients (where C.F.>30%)	Low	Medium[f] (19, Fd)	Low - pinegrass, fireweed	Mod.	H forest floor displacement hazard on all sites	Flat sites may be frost prone; Conserve limited organic matter
04	32	Cold air temp., Dry soil, Cold soil, Nutrients	Low	Medium[f] (19, Fd)	Medium - pinegrass, dry shrub, fireweed	Mod.	H forest floor displacement hazard on all sites	Flat sites may be frost prone; Seed-banking species prolific after fire; Conserve limited organic matter
01	34	Cold air temp., Dry soil, Cold soil	Med.	Good (20, Fd)	Medium - dry alder, mixed shrub, fireweed	Mod.	H forest floor displacement hazard on moderate slopes	Flat sites may be frost prone; Conserve limited organic matter

05	15	Cold air temp., Cold soil	Med.	Good (18, Sxw)	Medium - dry alder, mixed shrub, fireweed	High	-	Flat sites may be frost prone
06	20	Cold air temp., Cold soil, Nutrients (where C.F.>70%)	Med.	Good (21, Fd)	Medium - mixed shrub, fireweed	High	H forest floor displacement hazard on all sites	Windthrow hazard; Water table may rise post-harvest; Flat sites may be frost prone; Conserve limited organic matter; Riparian
07	10	Cold air temp., Wet soil, Cold soil, Vegetation, Nutrients (where water table <15 cm)	Low	Medium (13, Sxw)	Medium - mixed shrub	High	H forest floor displacement hazard on sites with near surface water table (<15 cm)	Windthrow hazard; Water table may rise post-harvest;Conserve organic matter on site when shallow water table; Riparian
08	7	Cold air temp., Cold soil, Wet soil, Vegetation Nutrients (where water table >30 cm)	Med.	No data	Medium - mixed shrub, fern	High	H forest floor displacement hazard on all sites	Windthrow hazard; Water table may rise post-harvest; Frost prone sites; Conserve limited organic matter; Riparian
09	4	Wet soil, Cold air, Cold soil	n.a.	n.a.	Medium - willow, sedge	High	H compaction and displacement hazard on all sites	No timber values; Random machine travel on snowpack; Riparian

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[a] **Caution**: Based on sample plot data; some interpretations expected to vary with individual site conditions. Use of original interpretive tools is necessary; these interpretations are presented here to "red flag" common concerns. This table outlines key considerations that should go into management decisions. Rationale and interpretive tools are discussed in Section 3.6.

[b] These include air temperature, soil temperature, vegetation, soil moisture, and soil nutrients; use of SYTEPREP recommended, see Section 3.6.1.

C.F. = coarse fragments.

[c] Complexes described in Newton and Comeau (1990).

[d] **Caution**: This is presented here to "red flag" common drainage needs and is not intended to substitute for site specific engineering interpretations, see Section 3.6.4.

[e] **Caution**: Site sensitivity keys must be used with your site data for the PHSP; see Section 3.6.5.

H = high, 30 - 45% = moderate slope, 45 - 60% = steep slope, >60% = very steep slope.

[f] Sample size less than five plots for site index determination.

ESSFdc1

Variant Summary

Okanagan Dry Cold Engelmann Spruce - Subalpine Fir Variant

Location: On upper slopes and ridge tops in the Okanagan Highlands and in the Midway Range of the Monashee Mountains. This variant is also found in the Kamloops Forest Region.

Elevation range: 1650 to 1950 m (south aspect); 1550 to 1950 m (north aspect).

Climate: Dry Climatic Region; no climate data. The ESSFdc1 is likely colder and wetter with more snow than the MSdm1 and ICHmk1; colder and drier with less snow than the ESSFwc1; and drier with less snow than the ESSFwc4.

Soils, geology, and landforms: Common rock types in the Okanagan Highlands area of the ESSFdc1 include granitics, basalt, andesite, argillite, and quartzite. In the Monashee Mountain area of this variant, bedrock consists of quartzite, granodiorite, quartz diorite, monzonite, basalt, andesite, sandstone, conglomerate, and argillite. Morainal soils with loamy surface textures occur on all slope positions. These soils often have sandy textures at depth. Glaciofluvial soils with silty or sandy textures are less common. These soils are located on mid to lower slopes. Silty textured fluvial soils occur on some lower and level slopes. Colluvial soils with sandy textures are limited to upper slopes.

Zonal vegetation: Climax zonal sites have stands of Bl and Se. Seral stands of Pl are very common. Dominant shrubs are white-flowered rhododendron and black huckleberry. Grouseberry is the dominant herb with lesser amounts of five-leaved bramble and mountain arnica.

Distinguishing the ESSFdc1 from adjoining subzones/variants

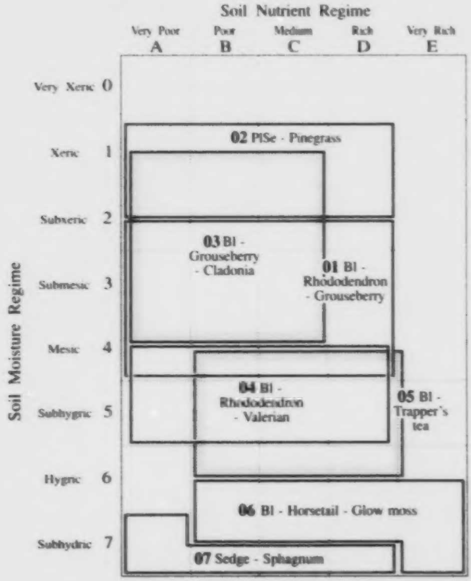
In the **MSdm1** most sites have:	- Fd and Lw - more Sitka alder, prince's pine, bunchberry, and rattlesnake-plantain - less white-flowered rhododendron and Sitka valerian
dry sites have:	- soopolallie, saskatoon, common snowberry, kinnikinnick, and yarrow
wet sites have:	- highbush-cranberry, baneberry, lady fern, oak fern, sweet-scented bedstraw, palmate coltsfoot, and pink wintergreen
In the **ICHmk1** most sites have:	- Fd, Lw, Cw, Douglas maple, saskatoon, tall Oregon-grape, red raspberry, and showy aster - no trapper's tea or subalpine daisy - more thimbleberry, soopolallie, prince's pine, and false Solomon's-seal - less white-flowered rhododendron, mountain arnica, and grouseberry
dry sites have:	- yarrow
wet sites have:	- red-osier dogwood and sweet-scented bedstraw
In the **ESSFwc1** most sites have:	- Cw, Hw, baneberry, and spiny wood fern - more Sitka mountain-ash, false Solomon's-seal, rosy twistedstalk, and knight's plume - less trapper's tea and arctic lupine
zonal and wetter sites have:	- devil's club and oak fern - less grouseberry or glow moss
wet sites have:	- less globeflower
In the **ESSFwc4** most sites have:	- oval-leaved blueberry, small twistedstalk, and spiny wood fern - no trapper's tea - more small-flowered woodrush and black gooseberry

	- less Pl
zonal and wetter sites have:	- no grouseberry
dry sites have:	- less common juniper and pinegrass

Forest characteristics: Extensive stands of Pl exist due to fire history and widespread coarse textured soils. Many of the forests in the ESSFdc1 and MSdm1 have been fragmented through extensive clearcut logging. The transition to the parkland, starting at about 1850 m, is critical since regeneration becomes very difficult and tree growth is very slow. The presence of mountain-heathers and tree islands indicate the parkland.

Wildlife habitat: The extensive fire history has maintained a predominance of early seral wildlife species. This variant is important summer range for deer, elk, and moose. The remaining pockets of old-growth are key to the maintenance of old-growth obligate species. In particular, snags and coarse woody debris are important to the maintenance of insect-feeding cavity-nesting birds which aid in control of forest insect pests.

ESSFdc1
Edatopic Grid


Soil Nutrient Regime
Very Poor A
Poor B
Medium C
Rich D
Very Rich E
Soil Moisture Regime
Very Xeric 0
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02 PlSe - Pinegrass
03 Bl - Grouseberry - Cladonia
01 Bl - Rhododendron - Grouseberry
04 Bl - Rhododendron - Valerian
05 Bl - Trapper's tea
06 Bl - Horsetail - Glow moss
07 Sedge - Sphagnum

Shading used where considerable site series overlap occurs.

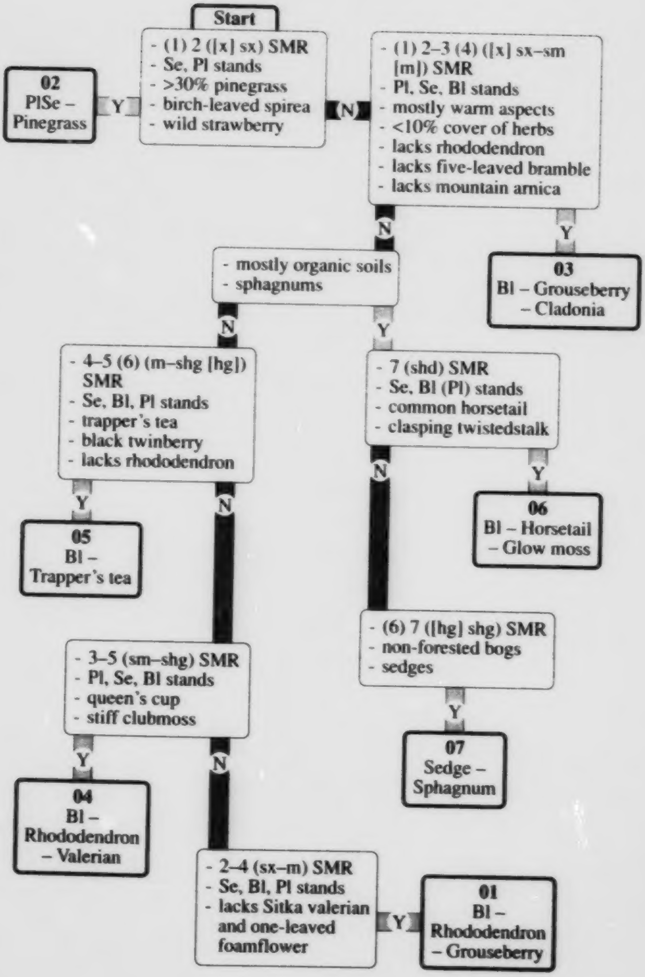
ESSFdc1 Vegetation Table

	Site Series	02	03	01	04	05	06	07	
TREES	*Picea engelmannii*	15 - 25%	1 - 7%	15 - 25%	15 - 25%	15 - 25%	15 - 25%	<1%	Engelmann spruce
	Pinus contorta	>25%	>25%	15 - 25%	15 - 25%	7 - 15%	1 - 7%		lodgepole pine
	Abies lasiocarpa	7 - 15%	15 - 25%	>25%	15 - 25%	15 - 25%	15 - 25%	<1%	subalpine fir
SHRUBS	*Spiraea betulifolia*	<1%							birch-leaved spirea
	Lonicera utahensis	1 - 7%	<1%	<1%	1 - 7%	<1%			Utah honeysuckle
	Vaccinium membranaceum	<1%	1 - 7%	15 - 25%	15 - 25%	1 - 7%	<1%		black huckleberry
	Rhododendron albiflorum			>25%	>25%				white-flowered rhododendron
	Ledum glandulosum		<1%	<1%		7 - 15%	7 - 15%	<1%	trapper's tea
HERBS	*Calamagrostis rubescens*	>25%							pinegrass
	Antennaria racemosa	1 - 7%							racemose pussytoes
	Fragaria virginiana	1 - 7%						<1%	wild strawberry
	Vaccinium scoparium	>25%	>25%	15 - 25%	15 - 25%	>25%	15 - 25%	1 - 7%	grouseberry
	Rubus pedatus			1 - 7%	7 - 15%	7 - 15%	1 - 7%		five-leaved bramble
	Arnica latifolia			1 - 7%	1 - 7%	1 - 7%	<1%	<1%	mountain arnica
	Clintonia uniflora				1 - 7%	<1%			queen's cup
	Veratrum viride				1 - 7%	<1%		<1%	Indian hellebore
	Tiarella trifoliata var. unifoliata				1 - 7%	<1%			one-leaved foamflower
	Valeriana sitchensis				15 - 25%	15 - 25%	7 - 15%	1 - 7%	Sitka valerian
	Streptopus amplexifolius					<1%	1 - 7%		clasping twistedstalk
	Trollius laxus					<1%	<1%	<1%	globeflower
	Equisetum arvense						>25%		common horsetail
	Senecio triangularis						1 - 7%	<1%	arrow-leaved groundsel
	Carex spp.							7 - 15%	sedges
MOSSES AND LICHENS	*Cladonia* spp.	7 - 15%	7 - 15%	<1%		<1%	<1%		cladonias
	Barbilophozia spp.		<1%	1 - 7%	1 - 7%	<1%	1 - 7%		leafy liverworts
	Pleurozium schreberi	<1%	<1%	1 - 7%	1 - 7%	7 - 15%	<1%		red-stemmed feathermoss
	Mnium spp.				<1%	<1%	7 - 15%		leafy mosses
	Aulacomnium palustre				<1%	1 - 7%	7 - 15%	7 - 15%	glow moss
	Sphagnum spp.						15 - 25%	15 - 25%	sphagnums

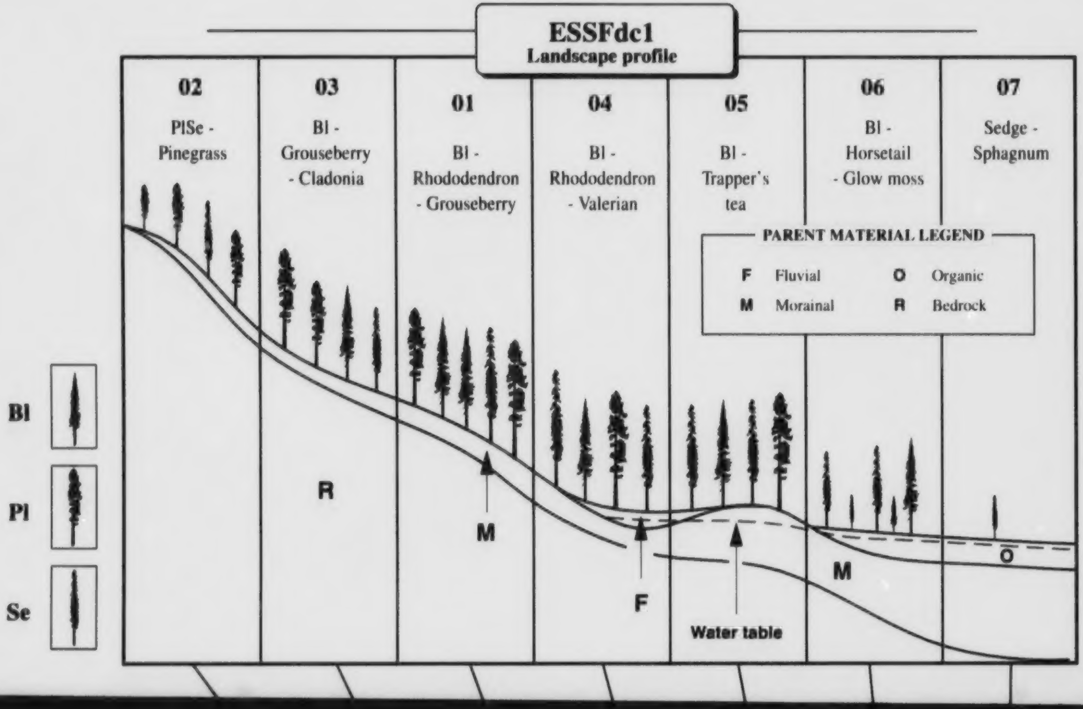
Approximate Cover Classes: ▫ <1% ▭ 1 - 7% ▭ 7 - 15% ▭ 15 - 25% ▭ >25%

ESSFdc1

Site Series Flowchart


Start
- (1) 2 ([x] sx) SMR
- Se, Pl stands
- >30% pinegrass
- birch-leaved spirea
- wild strawberry
Y
02
PlSe – Pinegrass
N
- (1) 2–3 (4) ([x] sx–sm [m]) SMR
- Pl, Se, Bl stands
- mostly warm aspects
- <10% cover of herbs
- lacks rhododendron
- lacks five-leaved bramble
- lacks mountain arnica
Y
03
Bl – Grouseberry – Cladonia
N
- mostly organic soils
- sphagnums
N
- 4–5 (6) (m–shg [hg]) SMR
- Se, Bl, Pl stands
- trapper's tea
- black twinberry
- lacks rhododendron
Y
05
Bl – Trapper's tea
N
- 3–5 (sm–shg) SMR
- Pl, Se, Bl stands
- queen's cup
- stiff clubmoss
Y
04
Bl – Rhododendron – Valerian
N
- 2–4 (sx–m) SMR
- Se, Bl, Pl stands
- lacks Sitka valerian and one-leaved foamflower
Y
01
Bl – Rhododendron – Grouseberry
Y
- 7 (shd) SMR
- Se, Bl (Pl) stands
- common horsetail
- clasping twistedstalk
Y
06
Bl – Horsetail – Glow moss
N
- (6) 7 ([hg] shg) SMR
- non-forested bogs
- sedges
Y
07
Sedge – Sphagnum

Y = Yes; N = No



ESSFdc1
Landscape profile

02
PlSe - Pinegrass
03
Bl - Grouseberry - Cladonia
01
Bl - Rhododendron - Grouseberry
04
Bl - Rhododendron - Valerian
05
Bl - Trapper's tea
06
Bl - Horsetail - Glow moss
07
Sedge - Sphagnum
PARENT MATERIAL LEGEND
F Fluvial
M Morainal
O Organic
R Bedrock
R
M
F
Water table
M
O
Bl
Pl
Se

ESSFdc1 Environmental Table

Site series		02	03	01	04	05	06	07
Number of plots		2	28	11	13	23	6	10
Soil moisture regime[a] (SMR)		2 sx	(1)[b]2-3(4) (x)sx-sm(m)	2-4 sx-m	3-5 sm-shg	4-5-(6) m-shg-(hg)	7 shd	(6)7 (hg)shd
Aspect		variable	mostly warm	mostly cool	variable	n.a.	n.a.	n.a.
Slope gradient %		35-50	0-30	20-45	0-25	0-20	0-7	0-5
Slope position		upper	crest-mid, level	upper-mid	mid-lower	mid-lower, depressions	depressions	level, depressions
Parent material		M	M(C,FG)	M	M(F,FG)	M(F)	O	O
Soil texture coarse fragments % (min.-**mean**-max.)	0-30 cm	L 23-**39**-55	L(S,$) 30-**36**-45	L($) 45-**64**-88	L($) 15-**38**-47	L(S,$,C) 8-**36**-50	organic (L) 0-**27**-80	organic (S,$) 0-**13**-40
	30+ cm	S 40-**63**-85	S,L(C) 40-**46**-60	L(S) 75-**81**-94	L,S 50-**57**-80	S,L 25-**49**-75	organic (L) 0	organic (L) 0
Humus form — LFH thickness cm (min.-**mean**-max.)		Mor 1-**2.5**-4	Mor 1-**4**-40	Mor 1-**5**-12	Mor 1-**5**-10	Mor 2-**7**-18	organic soils	organic soils
Important site features		—	some restricting layers	some restricting layers	some seepage	water table 30 -100 cm	water at or near surface	water at or near surface

[a] Environmental features contained in this table are defined in Section 3.4.4.

[b] Values in brackets less common.

ESSFdc1

Management Interpretations[a]

Site series	Number of plots	Common seedling growth limiting factors[a,b]	Relative tree productivity		Vegetation potential - common complexes[c]	Road drainage control needs (see cautions[a,e])	Common site sensitivities (see cautions[a,e])	Other prescription considerations[f]
			Gross volume productivity	Growth class (site index, tree species)				
02	2	Dry soil, Cold soil, Nutrients	Low	Medium[g] (13, Se)	Low - pinegrass	Low	H forest floor displacement hazard on all sites	Conserve limited organic matter
03	28	Dry soil, Cold soil, Nutrients	Low	Medium[g] (13, Se)	Low - fireweed	Mod.	H forest floor displacement hazard on all sites	Conserve limited organic matter
01	11	Dry soil, Cold air temp., Nutrients	Low	Poor (11, Se)	Medium - ericaceous shrub, fireweed	Mod.	H forest floor displacement hazard on all sites	Conserve limited organic matter
04	13	Cold air temp., Cold soil, Nutrients	Med.	Good (18, Se)	Medium - ericaceous shrub, fireweed, subalpine herb	High	H forest floor displacement hazard on all sites	Frost prone sites; Conserve limited organic matter

05	23	Cold air temp., Cold soil	Low	Poor (10, Se)	Medium - fireweed, ericaceous shrub	High	-	Windthrow hazard; Water table may rise post-harvest; Frost prone sites; Partial cutting questionable; Riparian
06	6	Cold air temp., Cold soil, Wet soil, Nutrients	Med.	Medium (13, Se)	Medium - ericaceous shrub, subalpine herb	High	H compaction and displacement hazard on organic soils; H forest floor displacement hazard on mineral soils with near surface water table and/or seepage (<30cm)	Windthrow hazard; Water table may rise post harvest; Frost prone sites; Partial cutting questionable; Unfavorable substrate when shallow water table; Random machine travel on organic soils on snowpack; Conserve organic matter when shallow water table; Riparian
07	10	Cold air temp., Cold soil, Wet soil, Nutrients	n.a.	n.a.	Medium - sedges, subalpine herb	High	H compaction and displacement hazard on organic soils; H forest floor displacement hazard on mineral soils with near surface water table and/or seepage (<30cm)	No timber values; Random machine travel on organic soils on snowpack; Riparian

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[a] **Caution:** Based on sample plot data; some interpretations expected to vary with individual site conditions. Use of original interpretive tools is necessary; these interpreptations are presented here to "red flag" common concerns. This table outlines key considerations that should go into management decisions. Rationale and interpretive tools are discussed in Section 3.6.

[b] These include air temperature, soil temperature, vegetation, soil moisture, and soil nutrients; use of SYTEPREP recommended, see Section 3.6.1.

[c] Complexes described in Newton and Comeau (1990).

[d] **Caution:** This is presented here to "red flag" common drainage needs and is not intended to substitute for site specific engineering interpretations, see Section 3.6.4.

[e] **Caution:** Site sensitivity keys must be used with your site data for the PHSP; see Section 3.6.5. H = high.

[f] Partial cutting or no harvesting recommended where regeneration restricted to tree islands (above approximately 1 850 m).

[g] Sample size less than five plots for site index determination.

ESSFdk

Subzone Summary

Dry Cool Engelmann Spruce - Subalpine Fir Subzone

Location: Upper slopes in the eastern Purcell Mountains south of the Spillimacheen River and in the Rocky Mountains south of the Kickinghorse River.

Elevation range: 1650 to 2100 m (south aspect); 1550 to 2100 m (north aspect).

Climate[24]: Dry Climatic Region; cool, moist summers; very cold winters with heavy snowfall. Soils dry out for a moderate to nonexistent time period in late summer. Snowpacks are moderate in depth and duration, preventing the soils from freezing to any significant depth, unless soils are bladed. Cold soils and air temperatures and late lying snow are the major factors limiting tree growth.

Soils, geology, and landforms: Common rock types in the Purcell Mountain area of the ESSFdk include quartzite, argillite, limestone, siltstone, granodiorite and quartz diorite. In the Rocky Mountain area of this subzone, bedrock consists of limestone, dolomite, calcareous shale, sandstone, conglomerate, schist, phyllite and quartzite. Colluvial soils with sandy or loamy textures and high coarse fragment contents occur on steep, upper slopes. Morainal soils with silty or loamy surface textures occur on mid to lower slopes. Fluvial and glaciofluvial soils with silty, sandy or clayey textures are found on lower and level slope positions. In the Rocky Mountain area, many of the above soils have clayey subsoils. Silty eolian deposits are not uncommon, and represent important nutrient sources. Many sites within this subzone have calcareous subsoil horizons.

Zonal vegetation: Climax zonal sites have stands of Bl and Se. The dominant shrub is false azalea with lesser amounts of black huckleberry and black gooseberry. Grouseberry, low bilberry, arnicas, western meadowrue and one-leaved foamflower are the common herbs.

Distinguishing the ESSFdk from adjacent subzones/variants

In the **MSdk** most sites have:	- more Fd, Lw, At, tall Oregon-grape, prince's pine, pinegrass, saskatoon, prickly rose, and bedstraws - less white-flowered rhododendron, black huckleberry, false azalea, grouseberry, Indian hellebore, and Sitka valerian
dry sites have:	- more kinnikinnick
wet sites have:	- more red-osier dogwood
In the **ICHmk1** most sites have:	- Cw, falsebox, tall Oregon-grape, thimbleberry, and prince's pine - no leafy liverwort (*Barbilophozia*) or Indian hellebore - more Fd, Lw, and saskatoon - less grouseberry and false azalea
dry sites have:	- kinnikinnick
In the **ESSFwm** most sites have:	- no pinegrass - more Cw and Hw
zonal and wetter sites have:	- oak fern and red-stemmed feathermoss
dry sites have:	- more white-flowered rhododendron
wet sites have:	- one-leaved foamflower

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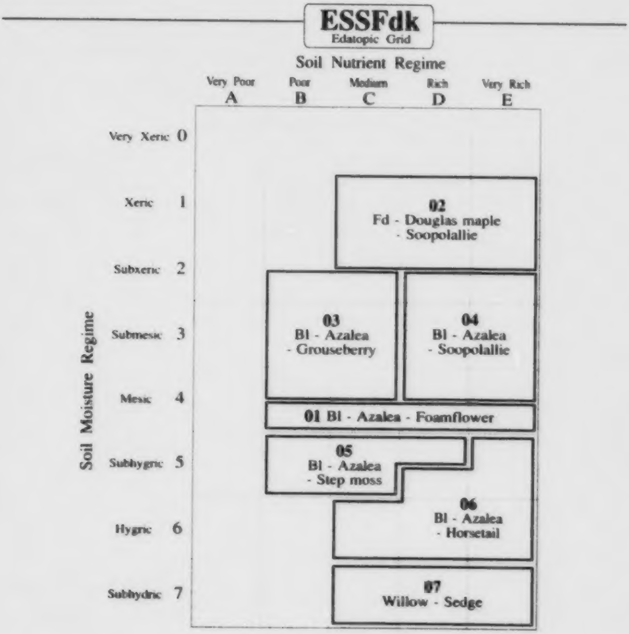
[24] Values for climate descriptors given in Appendix 12.

Forest characteristics: Fd and Lw are found at higher elevation (up to 1800 m) in this subzone than anywhere else in this region. Due to relatively light snow, productive forests are found to about 2000 m (higher than elsewhere in the region). It is important to note the transition to the parkland, starting at about 1950 m. This transition can be recognized by the presence of high elevation species such as mountain-heathers and the occurrence of tree islands. Tree growth is extremely slow and regeneration is very problematic in the parkland.

Wildlife habitat: Moderate terrain and good habitat conditions in this subzone make it one of the most productive wildlife habitats in the Nelson Forest Region. Old growth is important in the maintenance of wildlife populations and should be protected. Seral stages provide highly productive deer, elk, and moose summer range. Early seral vegetation in avalanche and riparian areas is good habitat for grizzly bears.


ESSFdk
Edatopic Grid
Soil Nutrient Regime
Very Poor A
Poor B
Medium C
Rich D
Very Rich E
Soil Moisture Regime
Very Xeric 0
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02 Fd - Douglas maple - Soopolallie
03 Bl - Azalea - Grouseberry
04 Bl - Azalea - Soopolallie
01 Bl - Azalea - Foamflower
05 Bl - Azalea - Step moss
06 Bl - Azalea - Horsetail
07 Willow - Sedge

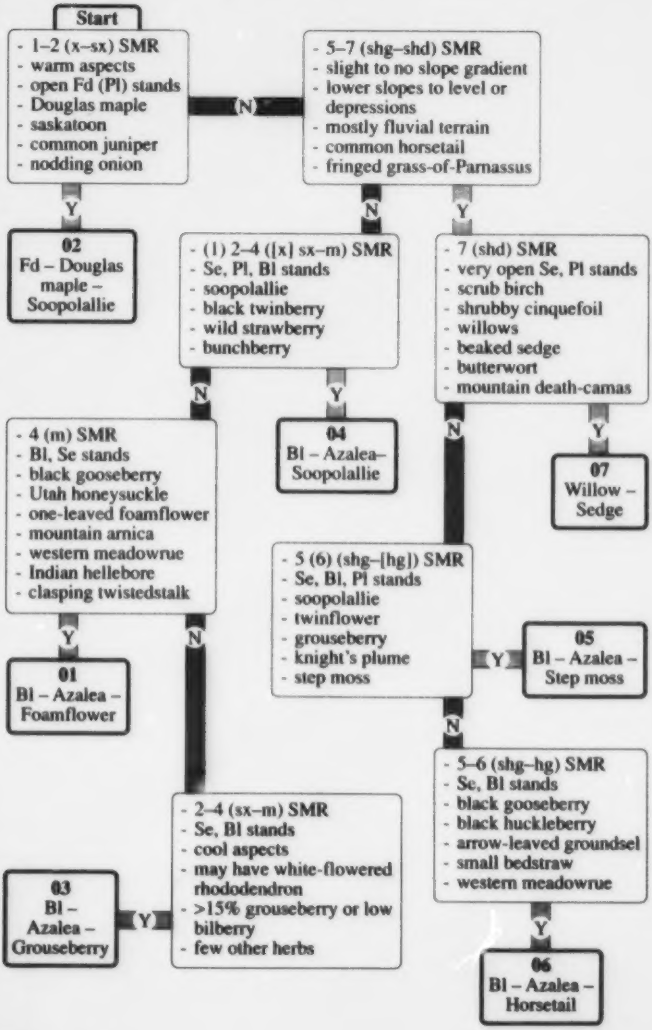
ESSFdk Vegetation Table

	Site Series	02	03	04	01	05	06	07	
TREES	*Pseudotsuga menziesii*	15 - 25%		<1%					Douglas-fir
	Pinus contorta	1 - 7%	7 - 15%	7 - 15%	<1%	7 - 15%	<1%	1 - 7%	lodgepole pine
	Abies lasiocarpa	<1%	15 - 25%	15 - 25%	>25%	15 - 25%	15 - 25%		subalpine fir
	Picea engelmannii		15 - 25%	15 - 25%	15 - 25%	15 - 25%	15 - 25%	1 - 7%	Engelmann spruce
SHRUBS	*Acer glabrum*	15 - 25%							Douglas maple
	Amelanchier alnifolia	1 - 7%							saskatoon
	Juniperus communis	1 - 7%							common juniper
	Shepherdia canadensis	7 - 15%		1 - 7%				<1%	soopolallie
	Ribes lacustre	<1%		<1%	1 - 7%		1 - 7%		black gooseberry
	Menziesia ferruginea		>25%	>25%	>25%	7 - 15%	7 - 15%		false azalea
	Lonicera utahensis			<1%	<1%	<1%			Utah honeysuckle
	Vaccinium membranaceum		1 - 7%		1 - 7%		1 - 7%		black huckleberry
	Betula glandulosa							1 - 7%	scrub birch
	Potentilla fruticosa							1 - 7%	shrubby cinquefoil
	Salix spp.							1 - 7%	willows
HERBS	*Calamagrostis rubescens*	1 - 7%		<1%	<1%				pinegrass
	Epilobium angustifolium	<1%							fireweed
	Heuchera cylindrica	1 - 7%							round-leaved alumroot
	Aster conspicuus	1 - 7%		1 - 7%					showy aster
	Fragaria virginiana	1 - 7%							wild strawberry
	Arnica cordifolia		<1%	7 - 15%	1 - 7%	<1%			heart-leaved arnica
	Cornus canadensis		<1%	1 - 7%		1 - 7%	<1%		bunchberry
	Linnaea borealis	<1%		1 - 7%		<1%			twinflower
	Vaccinium myrtillus		>25%	15 - 25%	1 - 7%	<1%			low bilberry
	Vaccinium scoparium		7 - 15%	7 - 15%	1 - 7%	7 - 15%			grouseberry
	Orthilia secunda		<1%	<1%	<1%				one-sided wintergreen
	Thalictrum occidentale	<1%		<1%	1 - 7%	<1%			western meadowrue
	Arnica latifolia		<1%	1 - 7%	1 - 7%	<1%	<1%		mountain arnica
	Veratrum viride				<1%				Indian hellebore
	Tiarella trifoliata var. unifoliata				1 - 7%		<1%		one-leaved foamflower
	Equisetum arvense						7 - 15%		common horsetail
	Senecio triangularis						1 - 7%		arrow-leaved groundsel
	Carex rostrata							>25%	beaked sedge
MOSSES	*Pleurozium schreberi*		>25%	>25%	7 - 15%	>25%	<1%		red-stemmed feathermoss
	Hylocomium splendens		<1%	7 - 15%		>25%			step moss
	Ptilium crista-castrensis		<1%	1 - 7%	1 - 7%	15 - 25%			knight's plume
	Aulacomnium palustre					<1%		1 - 7%	glow moss

Approximate Cover Classes: ▭ <1% ▭ 1 - 7% ▭ 7 - 15% ▭ 15 - 25% ▭ >25%

ESSFdk

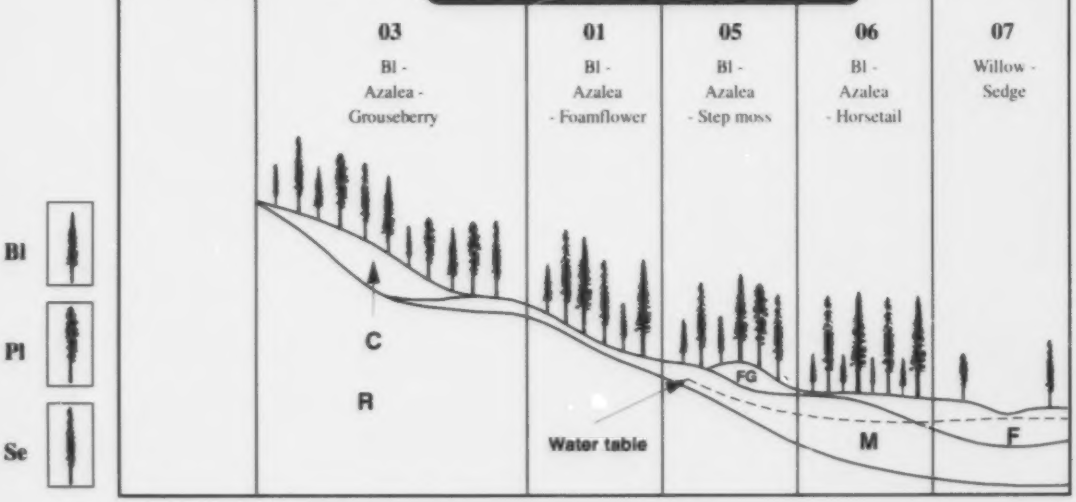
Site Series Flowchart


Start
- 1–2 (x–sx) SMR
- warm aspects
- open Fd (Pl) stands
- Douglas maple
- saskatoon
- common juniper
- nodding onion
Y
02
Fd – Douglas maple – Soopolallie
N
- 5–7 (shg–shd) SMR
- slight to no slope gradient
- lower slopes to level or depressions
- mostly fluvial terrain
- common horsetail
- fringed grass-of-Parnassus
N
Y
- (1) 2–4 ([x] sx–m) SMR
- Se, Pl, Bl stands
- soopolallie
- black twinberry
- wild strawberry
- bunchberry
Y
04
Bl – Azalea–Soopolallie
N
- 4 (m) SMR
- Bl, Se stands
- black gooseberry
- Utah honeysuckle
- one-leaved foamflower
- mountain arnica
- western meadowrue
- Indian hellebore
- clasping twistedstalk
Y
01
Bl – Azalea – Foamflower
N
- 2–4 (sx–m) SMR
- Se, Bl stands
- cool aspects
- may have white-flowered rhododendron
- >15% grouseberry or low bilberry
- few other herbs
Y
03
Bl – Azalea – Grouseberry
- 7 (shd) SMR
- very open Se, Pl stands
- scrub birch
- shrubby cinquefoil
- willows
- beaked sedge
- butterwort
- mountain death-camas
Y
07
Willow – Sedge
N
- 5 (6) (shg–[hg]) SMR
- Se, Bl, Pl stands
- soopolallie
- twinflower
- grouseberry
- knight's plume
- step moss
Y
05
Bl – Azalea – Step moss
N
- 5–6 (shg–hg) SMR
- Se, Bl stands
- black gooseberry
- black huckleberry
- arrow-leaved groundsel
- small bedstraw
- western meadowrue
Y
06
Bl – Azalea – Horsetail

Y = Yes; N = No

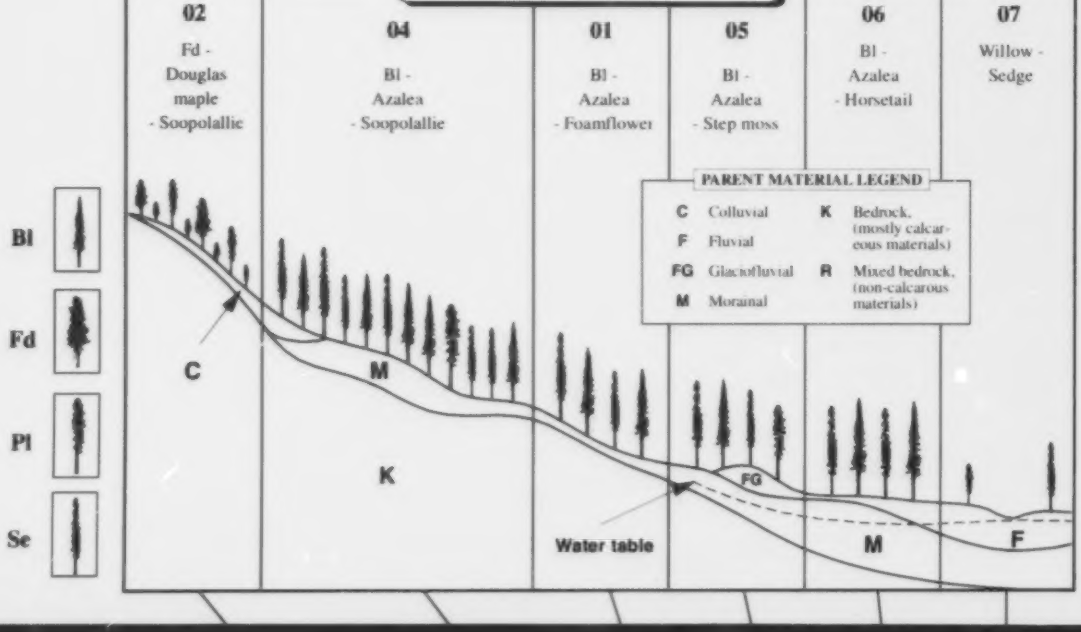
ESSFdk (non-calcareous bedrock)

Landscape profile


03
Bl - Azalea - Grouseberry
01
Bl - Azalea - Foamflower
05
Bl - Azalea - Step moss
06
Bl - Azalea - Horsetail
07
Willow - Sedge
C
R
FG
M
F
Water table
Bl
Pl
Se

ESSFdk (calcareous bedrock)

Landscape profile


02
Fd - Douglas maple - Soopolallie
04
Bl - Azalea - Soopolallie
01
Bl - Azalea - Foamflower
05
Bl - Azalea - Step moss
06
Bl - Azalea - Horsetail
07
Willow - Sedge
PARENT MATERIAL LEGEND
C Colluvial
F Fluvial
FG Glaciofluvial
M Morainal
K Bedrock, (mostly calcareous materials)
R Mixed bedrock, (non-calcarous materials)
C
M
K
FG
M
F
Water table
Bl
Fd
Pl
Se

ESSFdk Environmental Table

Site series		02	03	04	01	05	06	07
Number of plots		4	20	16	8	4	4	3
Soil moisture regime[a] (SMR)		1-2 x-sx	2-4 sx-m	(1)[b]2-4 (x)sx-m	4 m	5(6) shg(hg)	5-6 shg-hg	7 shd
Aspect		warm	cool	variable	variable	n.a.	variable	n.a.
Slope gradient %		35-75	15-30	5-50	10-50	0-10	5-20	0-10
Slope position		upper-lower	(upper) mid-lower	mid-lower	mid-lower	lower-level	mid-level	lower to depression
Parent material		C	C,M	C,M,F	M,C	variable	F	F
Soil texture coarse fragments % (min.-**mean**-max.)	0-30 cm	L(C,$) 45-**55**-69	L,$ 15-**35**-60	L,(C,S) 15-**35**-52	$ 9-**15**-20	C,S,$,L 0-**8**-8	C,S,$ 25-**36**-45	$(L) 4-**21**-30
	30+ cm	C,S,L 60-**75**-85	L(C,S,$) 45-**62**-80	L,C,S 40-**58**-70	C 5-**38**-85	C,S 23-**38**-65	C,S,$ 10-**35**-76	S,$,L 0-**43**-80
Humus form — LFH thickness cm (min.-**mean**-max.)		Mull, Mor 3-**4**-6	Mor 2-**5**-10	Mor 4-**8**-15	Mor 4-**7**-8	Mor 4-**11**-22	Mor 2-**3**-5	Mor 1-**13**-24
Important site features		restricting layers; calcareous	non-calcareous	eolian veneers; calcareous	—	found in cold air drainages below ESSFdk elevation band	—	—

[a] Environmental features contained in this table are defined in Section 3.4.4.
[b] Values in brackets less common.

ESSFdk

Management Interpretations[a]

Site series	Number of plots	Common seedling growth limiting factors[a,b]	Relative tree productivity		Vegetation potential - common complexes[c]	Road drainage control needs (see cautions[a,e])	Common site sensitivities (see cautions[a,e])	Other prescription considerations[f]
			Gross volume productivity	Growth class (site index, tree species)				
02	4	Dry soil, Nutrients	Low	Poor[g] (14, Fd)	Low - dry shrub, pinegrass	Low	H displacement hazard on steep slopes; H forest floor displacement hazard on sites with more humus forms; H mass wasting hazard on steep, clayey soils	Conserve limited organic matter on mor humus forms
03	20	Cold soil, Dry soil, Cold air temp., Nutrients	Low	Medium (16, Se)	Medium - ericaceous shrub, fireweed	Mod.	H forest floor displacement hazard on all sites	Conserve limited organic matter
04	16	Cold air temp., Dry soil, Cold soil, Nutrients (on slopes 30-60%)	Low	Medium (16, Se)	Low - ericaceous shrub, pinegrass, fireweed	Mod.	H displacement and mass wasting hazard on steep slopes; H forest floor displacement hazard on moderate slopes	Conserve limited organic matter on moderate and steep slopes; Special road construction/maintenance on steep slopes

01	8	Cold air temp., Cold soil	Med.	Medium 15, Se)	Medium - ericaceous shrub, fireweed	Mod.	H compaction hazard on silty soils; H mass wasting hazard on steep slopes	Random machine travel on silty soils, on snowpack, or during short dry period; Special road construction/maintenance on steep slopes
05	4	Cold air temp., Cold soil	Med.	Medium[g] (13, Se)	Medium - ericaceous shrub, fireweed	High	H forest floor displacement hazard on all sites; H & VH compaction hazard on silty & clayey soils	Windthrow hazard; Water table may rise post-harvest; Frost prone sites; partial cutting questionable; Conserve limited organic matter; Random machine travel on silty/clayey soils on snowpack; Riparian
06	4	Cold air temp., Cold soil	Med.	No data	Medium - ericaceous shrub, subalpine herb	High	H forest floor displacement hazard on all sites; H & VH compaction hazard on silty & clayey soils	Windthrow hazard; Water table may rise post-harvest; Frost prone sites; Partial cutting questionable; Conserve limited organic matter; Random machine travel on snowpack on silty/clayey soils
07	3	Wet soil, Cold air temp., Cold soil	n.a.	n.a.	Medium - sedge	High	H mass wasting hazard on all sites; H compaction hazard on silty soils	No timber values; Frost prone sites; Special road construction/maintenance; Riparian

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[a] **Caution**: Based on sample plot data; some interpretations expected to vary with individual site conditions. Use of original interpretive tools is necessary; these interpretations are presented here to "red flag" common concerns. This table outlines key considerations that should go into management decisions. Rationale and interpretive tools are discussed in Section 3.6.

[b] These include air temperature, soil temperature, vegetation, soil moisture, and soil nutrients; use of SYTEPREP recommended, see Section 3.6.1.

[c] Complexes described in Newton and Comeau (1990).

[d] **Caution**: This is presented here to "red flag" common drainage needs and is not intended to substitute for site specific engineering interpretations, see Section 3.6.4.

[e] **Caution**: Site sensitivity keys must be used with your site data for the PHSP; see Section 3.6.5. VH = very high, H = high, >45% = steep slope, 30 - 45% = moderate slope.

[f] Partial cutting or no harvesting recommended where regeneration restricted to tree islands (above approximately 2 000 m).

[g] Sample size less than five plots for site index determination.

5.2 Moist Climatic Region

ICHxw[25]

Subzone Summary

Very Dry Warm Interior Cedar - Hemlock Subzone

Location: The ICHxw is present from mid slope to valley floors in the Pend d'Oreille Valley and on western and southern exposures and valley floors from Boswell to Kitchener (east of Creston). This subzone has limited occurrence in British Columbia and occurs more extensively in northeast Washington and northern Idaho.

Elevation range: 450 to 1100 m

Climate[26]: The ICHxw is located in the Moist Climatic Region; very hot, dry summers and very mild winters with very light snowfall. The ICHxw has less precipitation, warmer summers, and more growing degree days than the ICHdw. Soils dry out for long to insignificant time periods in late summer. Snowpacks are very shallow and of very short duration, but the soils generally do not freeze because of the mild climate. Moisture is one of the major limitations to tree growth.

Soils, geology, and landforms: Common rock types in the Selkirk mountains of the ICHxw include quartzite, argillite, limestone, phyllite, granite, and syenite. Rock types in the Purcell mountain areas of the subzone include quartzite, argillite, siltstone, granodiorite, and quartz diorite. Glaciofluvial soils with sandy to silty textures occur on lower and level slope positions. Morainal soils with loamy, sandy, or clayey textures cover lower to upper slope positions. Some morainal soils are calcareous. Steep, upper slope positions have colluvial soils with sandy rubbly textures. Loess cappings with silty textures are common in this subzone.

Zonal vegetation: Climax zonal sites are characterized by closed canopy stands of Fd and Py, with sporadic regeneration of Cw, Hw, and Bg. Common snowberry, ocean-spray, mock-orange, saskatoon, hazelnut, and baldhip rose are common shrubs. Fairybells and twinflower are the dominant herbs.

Drier sites of the ICHxw have open stands of Fd, Py, and Pl with redstem ceanothus, tall Oregon-grape, birch-leaved spirea, saskatoon, common snowberry, bluebunch wheatgrass, yarrow, pinegrass, and western fescue.

Wetter sites of the ICHxw have forested stands of Lw, Cw, Hw, Fd, Pw, and Bg with falsebox, devil's club, western yew, queen's cup, one-leaved foamflower, prince's pine, and twinflower.

Distinguishing the ICHxw from adjacent subzones/variants

In the **ICHdw** most sites have:	-	more Cw and black huckleberry
	-	less common snowberry, ocean-spray, ninebark, and mock-orange
dry sites have:	-	less bluebunch wheatgrass
wet sites have:	-	more five-leaved bramble and oak fern

Forest characteristics: The ICHxw has very few climax stands due to frequent wildfires. Douglas-fir is the dominant tree species; Py and Lw are also common; Cw, Bg, and rarely, Hw are found on mesic or wetter sites; Pl and Pw are less common seral species.

Wildlife habitat: Fire and the abandonment of farm fields, has resulted in extensive shrub fields and mixed Fd/Py stands. This environment supports a wide diversity of birds. Maintaining the natural diversity is important to these species. The ICHxw is very important winter habitat for ungulates, especially white-tailed deer and elk. The valley floor wetlands at Creston are very important habitat for birds and other aquatic species. The only known B.C. population of the Coeur d'Alene salamander is found near Kuskanook.

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[25] *Because of a lack of data, no vegetation or environment tables, site series flowchart, or management interpretation tables are provided. Please refer to the ICHdw management interpretations and consider the drier climate of the xw.*

[26] Values for climatic descriptors given in Appendix 12.

ICHdw

Subzone Summary

Dry Warm Interior Cedar - Hemlock Subzone

Location: Southern Monashee, Selkirk, and Purcell mountains; restricted to valley bottoms and lower slopes of the Upper Granby river; Christina Lake; Lower Arrow Lake, north to Fauquier; Columbia River, Slocan Valley, north to New Denver; Kootenay Valley, north to Kaslo; Goat River and southern Moyie River below the ICHmw2.

Elevation range: 450 to 1200 m (south aspect); 450 to 1000 m (north aspect).

Climate[27]**:** Moist Climatic Region; very hot, moist summers; very mild winters with light snowfall. Soils generally dry out for long to insignificant time periods in late summer. Snowpacks are very shallow to shallow and of short duration but, combined with the mild climate, result in no significant soil freezing, except for some bladed soils. Major growth-limiting factors include moisture on dry sites and frost on some depressional sites.

Soils, geology, and landforms: Common rock types in the Selkirk Mountain area of the ICHdw include granodiorite, quartz diorite, quartzite, siltstone, shale, argillite, and limestone. In the Purcell Mountain area of this subzone, bedrock consists of quartzite, argillite, siltstone, granodiorite, and quartz monzonite. In the Monashee Mountain area of this subzone, bedrock includes monzonite, diorite, gneiss, schist, argillite, and quartzite. Morainal soils with loamy to silty surface textures occur on lower to upper slopes. Colluvial soils with loamy or sandy textures are found on steep, upper slopes. Glaciofluvial soils with sandy or loamy textures are found in proximity to morainal soils. Loess cappings overlay glaciofluvial and other soils near Arrow and Kootenay lakes. These materials are silty textured and a good nutrient source. Fluvial soils with silty, sandy, or loamy textures occur on lower and level slopes. These soils often have strongly contrasting textures at depth. Mid to upper slopes often have root-restricting layers due to cemented soil horizons or shallow to bedrock areas.

Zonal vegetation: Climax zonal sites have stands of Cw and Hw. Mixed seral stands of Fd, Ep, Lw, and Pw are much more common. Falsebox, Douglas maple, black huckleberry, and baldhip rose are the most common shrubs. Common herbs include twinflower, prince's pine, queen's cup, and wild sarsaparilla.

Distinguishing the ICHdw from adjoining subzones/variants

In the **MSdk** most sites have:	- no Hw, Pw, Bg, queen's cup, falsebox, or black huckleberry - more pinegrass, showy aster, and grouseberry - less Cw or Douglas maple
wet sites have:	- no lady fern, oak fern, or devil's club
In the **ICHmk1** most sites have:	- no Hw or Bg - more Bl, Sxw, Pl, showy aster, pinegrass, and bunchberry - less Pw
dry sites have:	- no ocean-spray - less Py

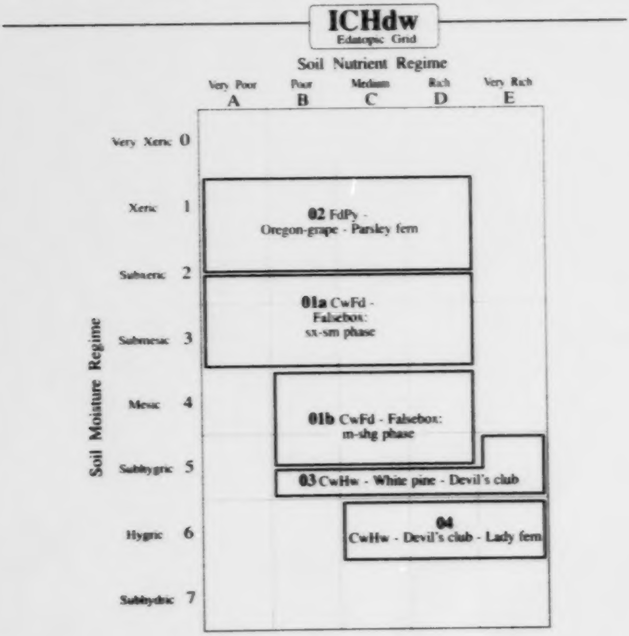
---

[27] Values for climate descriptors given in Appendix 12.

In the ICHmw2 most sites have:	- no Py or Bg - more Bl and Sxw
zonal sites also have:	- moss-dominated rather than shrub-dominated stands
dry sites have:	- no ocean-spray
In the ICHxw most sites have:	- less Cw and Hw
zonal sites also have:	- ocean-spray, mallow ninebark, mock-orange, pinegrass, and western fescue

Forest characteristics: Fire origin stands of Fd and Lw are very common. Many of these stands originated around the turn of the century after fires set by miners. As a result of these fires and logging, very few climax or old-growth stands exist. The ICHdw is the most diverse subzone in the province in terms of tree species. It contains 14 commercial species and some species of rare occurrence in the Interior, such as cascara and black hawthorn.

Wildlife habitat: The major role of fire in the ICHdw has resulted in scattered old-growth Py stands. Maintenance of these old-growth habitats is key to wildlife protection. The extensive seral forests are important winter range for deer, elk and bighorn sheep and they support a wide diversity of wildlife species.


ICHdw
Edatopic Grid
Soil Nutrient Regime
Very Poor A
Poor B
Medium C
Rich D
Very Rich E
Soil Moisture Regime
Very Xeric 0
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02 FdPy - Oregon-grape - Parsley fern
01a CwFd - Falsebox: sx-sm phase
01b CwFd - Falsebox: m-shg phase
03 CwHw - White pine - Devil's club
04 CwHw - Devil's club - Lady fern

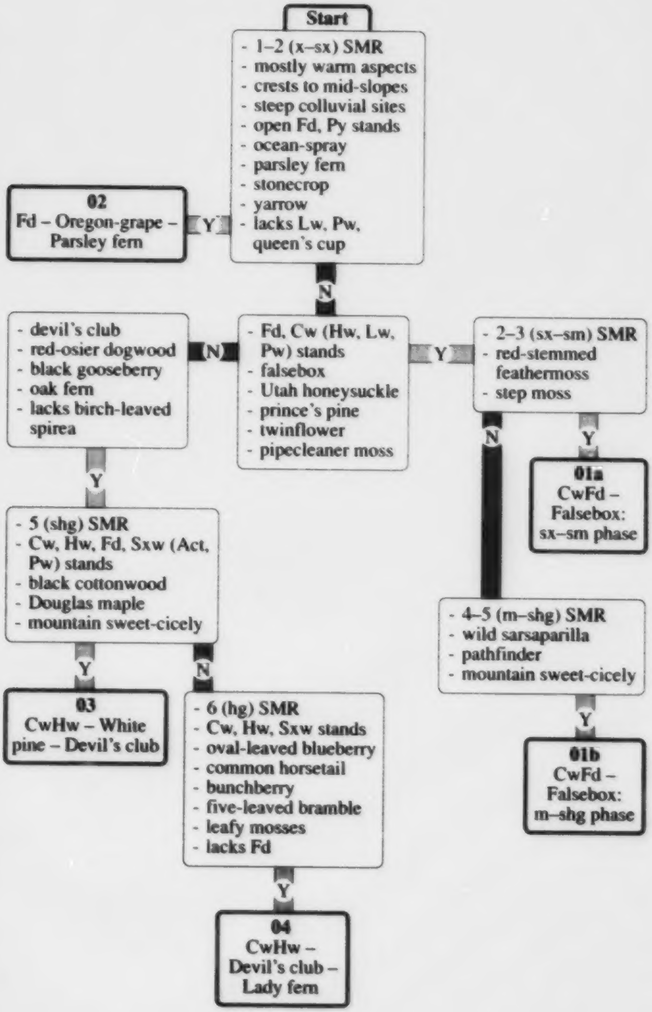
ICHdw Vegetation Table

	Site Series/Phases	02	01a	01b	03	04	
TREES	*Pinus ponderosa*	7 - 15%	<1%	<1%			ponderosa pine
	Pseudotsuga menziesii	15 - 25%	>25%	15 - 25%	7 - 15%		Douglas-fir
	Larix occidentalis		1 - 7%	1 - 7%			western larch
	Pinus monticola		<1%	<1%	1 - 7%		western white pine
	Betula papyrifera	<1%	1 - 7%	7 - 15%	1 - 7%	<1%	paper birch
	Thuja plicata		15 - 25%	15 - 25%	>25%	>25%	western redcedar
	Tsuga heterophylla		7 - 15%	15 - 25%	15 - 25%	>25%	western hemlock
	Populus balsamifera				1 - 7%		black cottonwood
	Picea glauca x engelmannii				<1%	1 - 7%	hybrid white spruce
SHRUBS	*Amelanchier alnifolia*	1 - 7%	<1%	<1%			saskatoon
	Mahonia aquifolium	1 - 7%	1 - 7%	<1%			tall Oregon-grape
	Spiraea betulifolia	<1%	1 - 7%	<1%			birch-leaved spirea
	Rosa gymnocarpa	<1%	<1%	1 - 7%			baldhip rose
	Acer glabrum	<1%	1 - 7%	1 - 7%	1 - 7%		Douglas maple
	Paxistima myrsinites		15 - 25%	7 - 15%		<1%	falsebox
	Vaccinium membranaceum		1 - 7%	1 - 7%		<1%	black huckleberry
	Taxus brevifolia			1 - 7%	1 - 7%	1 - 7%	western yew
	Oplopanax horridus				15 - 25%	15 - 25%	devil's club
	Cornus stolonifera					<1%	red-osier dogwood
	Vaccinium ovalifolium					1 - 7%	oval-leaved blueberry
HERBS	*Achillea millefolium*	<1%					yarrow
	Cryptogramma crispa	1 - 7%					parsley fern
	Festuca occidentalis	<1%					western fescue
	Hieracium albiflorum		<1%				white-flowered hawkweed
	Chimaphila umbellata		1 - 7%	7 - 15%			prince's pine
	Linnaea borealis	<1%	15 - 25%	15 - 25%	<1%	<1%	twinflower
	Clintonia uniflora		1 - 7%	7 - 15%	7 - 15%	1 - 7%	queen's cup
	Goodyera oblongifolia		<1%	<1%		<1%	rattlesnake-plantain
	Aralia nudicaulis		<1%	1 - 7%	1 - 7%		wild sarsaparilla
	Athyrium filix-femina				<1%	>25%	lady fern
	Galium triflorum				<1%	<1%	sweet-scented bedstraw
	Tiarella trifoliata var. unifoliata				7 - 15%	1 - 7%	one-leaved foamflower
	Gymnocarpium dryopteris				7 - 15%	>25%	oak fern
	Equisetum arvense					<1%	common horsetail
	Rubus pedatus					<1%	five-leaved bramble
MOSSES	*Pleurozium schreberi*	15 - 25%	7 - 15%	<1%			red-stemmed feathermoss
	Mnium spp.					>25%	leafy mosses

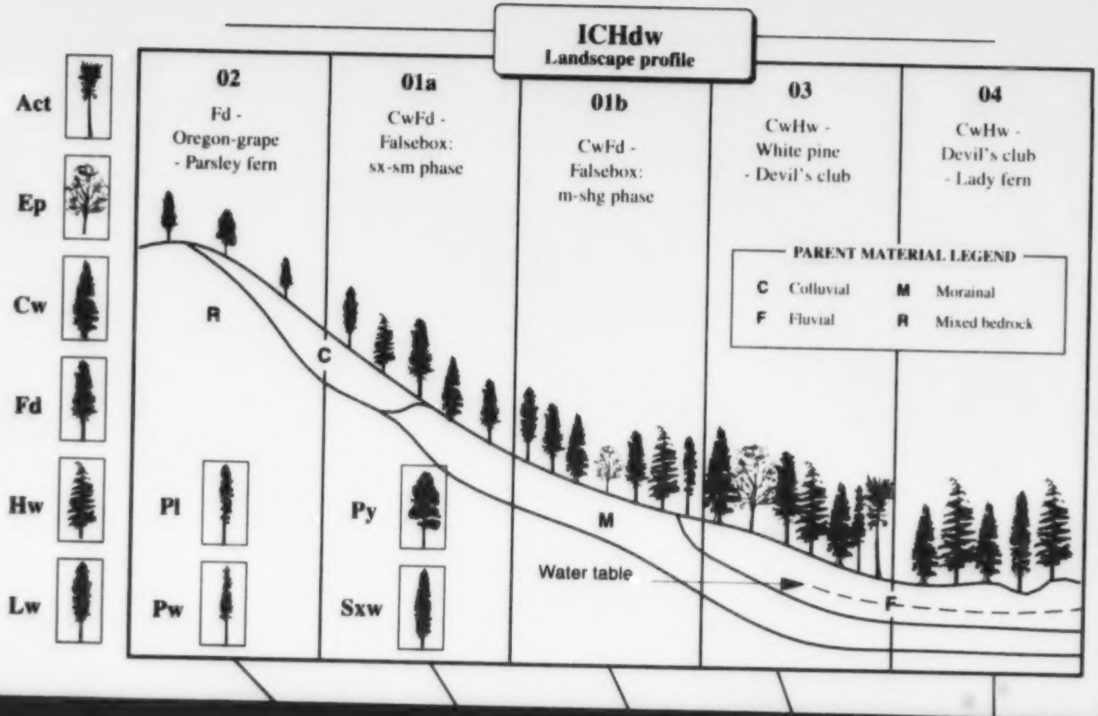
Approximate Cover Classes: <1% 1 - 7% 7 - 15% 15 - 25% >25%

ICHdw

Site Series Flowchart


Start
- 1–2 (x–sx) SMR
- mostly warm aspects
- crests to mid-slopes
- steep colluvial sites
- open Fd, Py stands
- ocean-spray
- parsley fern
- stonecrop
- yarrow
- lacks Lw, Pw, queen's cup
Y
02 Fd – Oregon-grape – Parsley fern
N
- Fd, Cw (Hw, Lw, Pw) stands
- falsebox
- Utah honeysuckle
- prince's pine
- twinflower
- pipecleaner moss
Y
- 2–3 (sx–sm) SMR
- red-stemmed feathermoss
- step moss
Y
01a CwFd – Falsebox: sx–sm phase
N
- 4–5 (m–shg) SMR
- wild sarsaparilla
- pathfinder
- mountain sweet-cicely
Y
01b CwFd – Falsebox: m–shg phase
N
- devil's club
- red-osier dogwood
- black gooseberry
- oak fern
- lacks birch-leaved spirea
Y
- 5 (shg) SMR
- Cw, Hw, Fd, Sxw (Act, Pw) stands
- black cottonwood
- Douglas maple
- mountain sweet-cicely
Y
03 CwHw – White pine – Devil's club
N
- 6 (hg) SMR
- Cw, Hw, Sxw stands
- oval-leaved blueberry
- common horsetail
- bunchberry
- five-leaved bramble
- leafy mosses
- lacks Fd
Y
04 CwHw – Devil's club – Lady fern

Y = Yes; N = No


ICHdw
Landscape profile
Act
Ep
Cw
Fd
Hw
Lw
02
Fd - Oregon-grape - Parsley fern
01a
CwFd - Falsebox: sx-sm phase
01b
CwFd - Falsebox: m-shg phase
03
CwHw - White pine - Devil's club
04
CwHw - Devil's club - Lady fern
PARENT MATERIAL LEGEND
C Colluvial
M Morainal
F Fluvial
R Mixed bedrock
R
C
M
F
Water table
Pl
Pw
Py
Sxw

ICHdw Environmental Table

Site series/phases		02	01a	01b	03	04
Number of plots		5	36	22	6	2
Soil moisture regime[a] (SMR)		1-2 x-sx	2-3 sx-sm	4(-5)[b] m(-shg)	5 shg	6 hg
Aspect		warm (variable)	variable	variable	variable	n.a.
Slope gradient %		40-80	variable	0-40	0-12	flat
Slope position		crest-mid	variable	mid-lower	level (lower)	level
Parent material		C(FG)	C,M,FG,F	M(FG,F)	F	F
Soil texture coarse fragments % (min.-**mean**-max.)	0-30 cm	L 30-**44**-50	L(S,$) 20-**45**-75	$,L 5-**21**-40	L,$(S) 2-**26**-45	S,$ 1-**10**-18
	30+ cm	L 19-**51**-92	S,L 40-**63**-85	L(C,S) 15-**40**-73	S,L(C) 20-**46**-65	S,L 5-**40**-75
Humus form — LFH thickness cm (min.-**mean**-max.)		Mor, Moder 2-**5**-9	Mor, Moder 1-**4**-10	Mor, Moder 1-**4**-13	Mor, Moder 5-**9**-16	Moder 5-**6**-7
Important site features		restricting layers common	—	—	temporary seepage	water table within 50 cm

[a] Environmental features contained in this table are defined in Section 3.4.4.

[b] Values in brackets less common.

ICHdw

Management Interpretations[a]

Site series	Number of plots	Common seedling growth limiting factors[a,b]	Relative tree productivity		Vegetation potential - common complexes[c]	Road drainage control needs (see cautions[a,e])	Common site sensitivities (see cautions[a,e])	Other prescription considerations[f]
			Gross volume productivity	Growth class (site index, tree species)				
02	5	Dry soil, Nutrients	Low	Poor[f] (14, Fd)	Low - dry shrub, fireweed	Low	H forest floor displacement hazard on all sites; H surface erosion hazard on very steep slopes; H displacement hazard on steep slopes	Partial cutting recommended; Seedbanking species prolific after fire; Conserve limited organic matter
01a	36	Dry soil, Nutrients	Low	Medium (20, Fd)	Medium - dry shrub, fireweed, mixed hardwood	Mod.	H forest floor displacement hazard on all sites; H mass wasting hazard on very steep slopes; H displacement hazard on steep slopes	Fire may dramatically increase seedbanking shrubs; Conserve limited organic matter; Special road construction/maintenance on very steep sites

01b	22	Nutrients (on >30% slopes)	Med.	Good (23, Fd)	Medium - fireweed, dry shrub, mixed hardwood	Mod.	H forest floor displacement hazard on all sites; H compaction hazard on silty soils	Fire may dramatically increase seedbanking shrubs; Conserve limited organic matter; Random machine travel on silty soils when dry
03	6	Vegetation	High	Good (25, Fd)	Medium - mixed shrub, fireweed	High	H compaction hazard on silty soils	Random machine travel on silty soils during short dry period
04	2	Vegetation, Cold air temp.	Med.	No data	High - mixed shrub, fern	High	H compaction hazard on silty soils	Windthrow hazard; Water table may rise post-harvest; Partial cutting questionable; Minimize machine travel on silty soils; Riparian

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[a] **Caution**: Based on sample data; some interpretations expected to vary with individual site conditions. Use of original interpretive tools is necessary; these interpretations are presented here to "red flag" common concerns. This table outlines key considerations that should go into management decisions. Rationale and interpretive tools are discussed in Section 3.6.

[b] These include air temperature, soil temperature, vegetation, soil moisture, and soil nutrients; use of SYTEPREP recommended, see Section 3.6.1.

[c] Complexes described in Newton and Comeau (1990).

[d] **Caution**: This is presented here to "red flag" common drainage needs and is not intended to substitute for site specific engineering interpretations, see Section 3.6.4.

[e] **Caution**: Site sensitivity keys must be used with your site data for the PHSP; see Section 3.6.5. H = high, 45 - 60% = steep slope, >60% = very steep slope.

[f] Sample size less than five plots for site index determination.

ICHmk1

Variant Summary

Kootenay Moist Cool Interior Cedar - Hemlock Variant

Location: Valley bottoms or areas of moderate relief between ICHmw1 , ICHmw2, or ICHdw and subzones of the Dry Climatic Region. The ICHmk1 occurs in the Rocky Mountains along the Lower Bull, Lower Elk River, Upper Kootenay, Beaverfoot, and Kickinghorse rivers; in the Rocky Mountain Trench between the Spillimacheen and Blaeberry rivers; in the southern Purcell Mountains along the St. Mary, Moyie, and Yahk rivers; and in the southern Monashee Mountains within the Kettle and Granby River drainages. This variant also occurs in the Kamloops Forest Region.

Elevation range: 800 to 1550 m (south aspect); 750 to 1500 m (north aspect).

Climate[38]**:** Moist Climatic Region; warm, wet summers; cool winters with moderate snowfall. Soils generally dry out for moderate to nonexistent time periods in late summer. Snowpacks are generally moderate in depth and duration. This prevents soil freezing to any significant depth, except for bladed soils. Soil temperature is a major growth limiting factor, along with air temperature, on depressional sites.

Soils, geology, and landforms: Common rock types in the Rocky Mountain area of the ICHmk1 include limestone, dolomite, calcareous shale, sandstone, argillite, and quartzite. The Rocky Mountain Trench area of this variant is underlain by recent sediments intermixed with hills of quartzite, limestone, calcareous phyllite, and sandstone. In the Purcell Mountain area of this variant, bedrock includes argillite, phyllite, siltstone, limestone, sandstone, granodiorite, quartz diorite, and schist. Rock types in the Monashee Mountain area of this variant include granitics, andesite, argillite, quartzite, sandstone, conglomerate, gneiss, schist, and basalt. Morainal soils with loamy, silty, or sandy surface textures occur on all slope positions. Glaciofluvial soils with loamy or sandy textures are found on lower to upper slopes in proximity to morainal soils. Soils often have a capping of fine silty loess. Fluvial soils with silty, sandy, or loamy textures occur on lower and level slopes. Steep, upper slopes have colluvial deposits with loamy or sandy textures. Upper slopes occasionally have root-restricting layers where bedrock or compact moraine occurs at shallow depths. Calcareous soils are common in the Rocky Mountain and adjacent Trench areas.

Zonal vegetation: Climax zonal sites have stands of Cw, Sxw, and Bl. Seral stands of Pl, Fd, and Lw are common. Falsebox, black huckleberry, and Utah honeysuckle are common shrubs. Common herbs are twinflower, bunchberry, queen's cup, and prince's pine. Red-stemmed feathermoss is very common.

Distinguishing the ICHmk1 from adjacent subzones/variants

In the **ESSFwc1** most sites have:	- white-flowered rhododendron and oval-leaved blueberry - no round-leaved violet or roses - less Fd and Lw
dry sites have:	- no pinegrass
wet sites have:	- spiny wood fern, Sitka valerian, and cow-parsnip - no red-osier dogwood
In the **ESSFdc1** most sites have:	- grouseberry, mountain arnica, and subalpine daisy - no Fd, Lw, Cw, Douglas maple, saskatoon, tall Oregon-grape, or showy aster - less prince's pine, thimbleberry, and false Solomon's-seal
zonal sites also have:	- white-flowered rhododendron
dry sites have:	- no yarrow - less soopolallie
wet sites have:	- trapper's tea - no red-osier dogwood, red raspberry, or sweet-scented bedstraw
In the **ICHdw** most sites have:	- Hw and Bg - more Pw and Py - less Bl, Sxw, Pl, showy aster, pinegrass, and bunchberry

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[38] Values for climate descriptors given in Appendix 12.

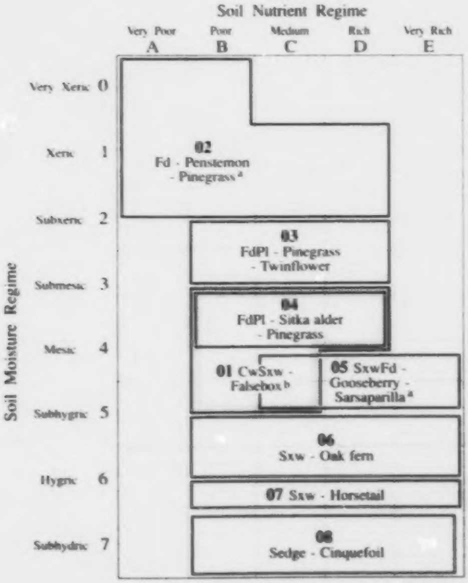
dry sites have:	- ocean-spray
In the **ICHmw2** most sites have:	- Pw, Hw, western yew, and oval-leaved blueberry
dry sites have:	- less pinegrass, cladinas, and racemose pussytoes
In the **MSdm1** most sites have:	- more heart-leaved arnica and grouseberry - less Douglas maple
zonal sites also have:	- no Cw
dry sites have:	- more round-leaved alumroot - less racemose pussytoes
wet sites have:	- more pink wintergreen

Forest characteristics: The ICHmk1 has been extensively disturbed by wildfires, so climax stands are rare. Seral stands with Pl are common. These stands have extensive mountain pine beetle history.

Range characteristics: Grazing is common in the lower elevations of this variant. Good livestock management is necessary to minimize the impacts on regeneration.

Wildlife habitat: This subzone is utilized during summer and fall by moose and deer. Pockets of old growth are important for maintaining insect-feeding, cavity nesting birds such as Williamson's Sapsucker and Black-backed Woodpecker. These species help to control forest insect pests.

ICHmk1
Edatopic Grid


Soil Nutrient Regime
Very Poor A
Poor B
Medium C
Rich D
Very Rich E
Soil Moisture Regime
Very Xeric 0
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02 Fd - Penstemon - Pinegrass a
03 FdPl - Pinegrass - Twinflower
04 FdPl - Sitka alder - Pinegrass
01 CwSxw - Falsebox b
05 SxwFd - Gooseberry - Sarsaparilla a
06 Sxw - Oak fern
07 Sxw - Horsetail
08 Sedge - Cinquefoil

Shading used where considerable site series overlap occurs.

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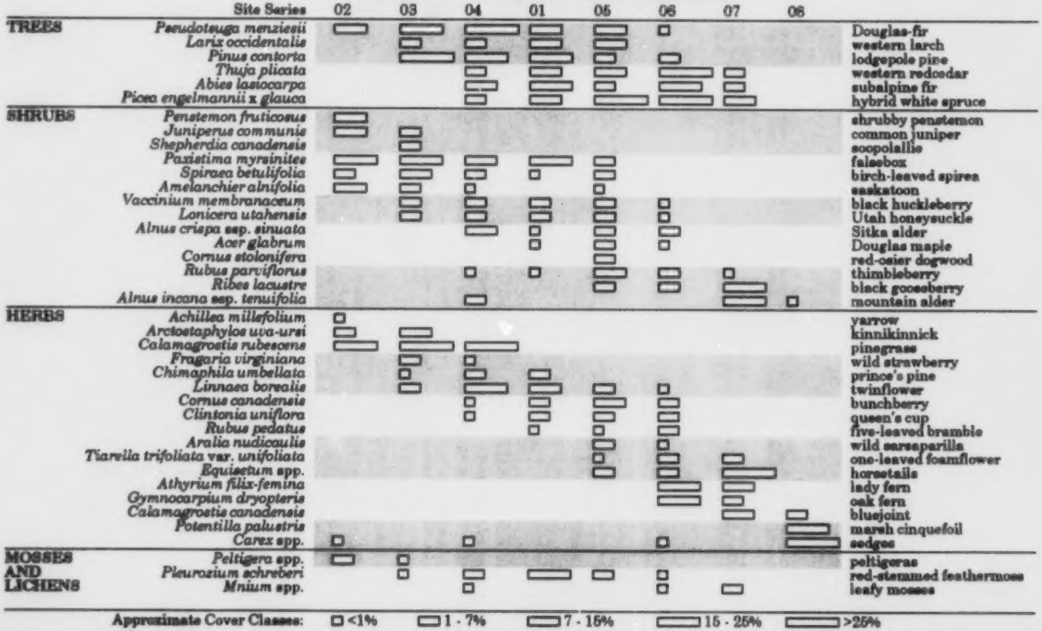
[a] Site Series 02 and 05 have different names in Lloyd *et al.* (1990)

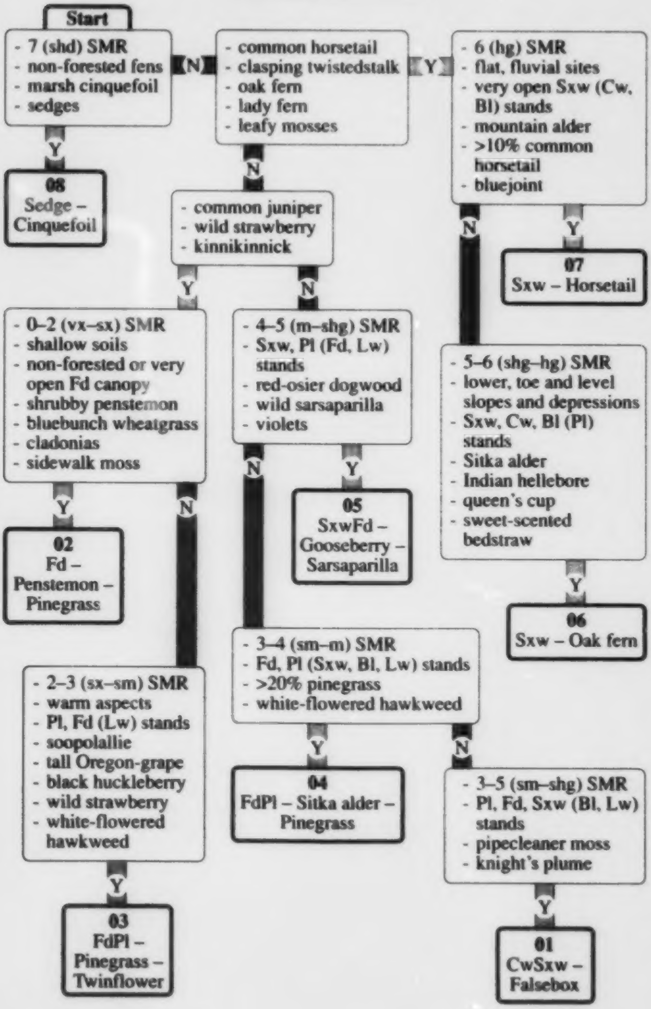
[b] 01 - YS in Lloyd *et al.* (1990) not recognized.

ICHmk1 Vegetation Table

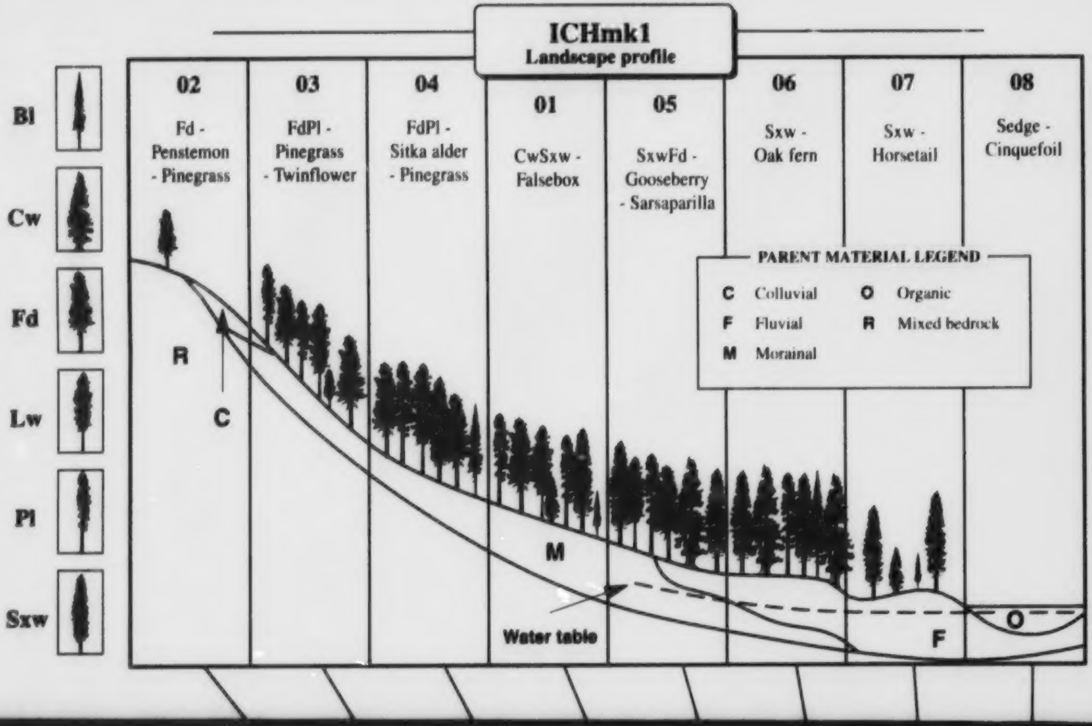


ICHmk1

Site Series Flowchart


Start
- 7 (shd) SMR
- non-forested fens
- marsh cinquefoil
- sedges
N
Y
08 Sedge – Cinquefoil
- common horsetail
- clasping twistedstalk
- oak fern
- lady fern
- leafy mosses
Y
N
- 6 (hg) SMR
- flat, fluvial sites
- very open Sxw (Cw, Bl) stands
- mountain alder
- >10% common horsetail
- bluejoint
N
Y
07 Sxw – Horsetail
- common juniper
- wild strawberry
- kinnikinnick
Y
N
- 0–2 (vx–sx) SMR
- shallow soils
- non-forested or very open Fd canopy
- shrubby penstemon
- bluebunch wheatgrass
- cladonias
- sidewalk moss
Y
N
02 Fd – Penstemon – Pinegrass
- 4–5 (m–shg) SMR
- Sxw, Pl (Fd, Lw) stands
- red-osier dogwood
- wild sarsaparilla
- violets
N
Y
05 SxwFd – Gooseberry – Sarsaparilla
- 5–6 (shg–hg) SMR
- lower, toe and level slopes and depressions
- Sxw, Cw, Bl (Pl) stands
- Sitka alder
- Indian hellebore
- queen's cup
- sweet-scented bedstraw
Y
06 Sxw – Oak fern
- 2–3 (sx–sm) SMR
- warm aspects
- Pl, Fd (Lw) stands
- soopolallie
- tall Oregon-grape
- black huckleberry
- wild strawberry
- white-flowered hawkweed
Y
03 FdPl – Pinegrass – Twinflower
- 3–4 (sm–m) SMR
- Fd, Pl (Sxw, Bl, Lw) stands
- >20% pinegrass
- white-flowered hawkweed
Y
N
04 FdPl – Sitka alder – Pinegrass
- 3–5 (sm–shg) SMR
- Pl, Fd, Sxw (Bl, Lw) stands
- pipecleaner moss
- knight's plume
Y
01 CwSxw – Falsebox

Y = Yes; N = No



ICHmk1
Landscape profile

Bl
Cw
Fd
Lw
Pl
Sxw
02
Fd - Penstemon - Pinegrass
03
FdPl - Pinegrass - Twinflower
04
FdPl - Sitka alder - Pinegrass
01
CwSxw - Falsebox
05
SxwFd - Gooseberry - Sarsaparilla
06
Sxw - Oak fern
07
Sxw - Horsetail
08
Sedge - Cinquefoil
PARENT MATERIAL LEGEND
C Colluvial
F Fluvial
M Morainal
O Organic
R Mixed bedrock
R
C
M
Water table
F
O

ICHmk1 Environmental Table

Site series		**02**	**03**	**04**	**01**	**05**	**06**	**07**	**08**
Number of plots		7	11	5	40	15	12	2	2
Soil moisture regime[a] (SMR)		0-2 vx-sx	2-3 sx-sm	3-4 sm-m	3-4(5)[b] sm-m(shg)	4-5 m-shg	5-6 shg-hg	6 hg	7 shd
Aspect		warm (variable)	warm	variable	variable	variable	variable	n.a.	n.a.
Slope gradient %		variable	20-53	variable	0-40	0-20	0-30	0	0
Slope position		crest and upper	upper-mid	upper-lower	upper-lower, level	mid-toe, depression	lower-toe, depression, level	level, depression	level, depression
Parent material		C(M)	M,C,FG(F)	M(C,F)	M,FG,F	F,M	F(M)	F	O
Soil texture coarse fragments % (min.-**mean**-max.)	0-30 cm	no data	L,S 25-**31**-27	L 40-**40**-40	L($,S) 5-**23**-40	$,L(S) 0-**10**-20	S,L(C,$) 0-**8**-15	no data	organic
	30+ cm	no data	L,S 28-**42**-55	L 67-**67**-67	S,C,L($) 16-**40**-60	S,L(C) 0-**23**-55	S,L(C,$) 2-**11**-20	no data	organic
Humus form — LFH thickness cm (min.-**mean**-max.)		Moder, Mor 1-**2**-3	Moder, Mor 1-**3**-5	Mor 3-**6**-13	Mor 0-**5**-22	Mor (Moder) 2-**8**-20	Mor, Moder 4-**8**-16	Mor, Moder, Mull 3-**7**-10	organic soil
Important site features		restricting layers common	—	some eolian veneers	some restricting layers	some seepage at depths 30-100 cm	some seepage at depths 30-100 cm	water table at depths 10-100 cm	water table 0-30 cm deep

[a] Environmental features contained in this table are defined in Section 3.4.4.

[b] Values in brackets less common.

ICHmk1

Management Interpretations[a]

Site series	Number of plots	Common seedling growth limiting factors[a,b]	Relative tree productivity		Vegetation potential - common complexes[c]	Road drainage control needs (see cautions[a,e])	Common site sensitivities (see cautions[a,e])	Other prescription considerations
			Gross volume productivity	Growth class (site index, tree species)				
02	7	Dry soil, Nutrients	Non-forest	n.a.	Low - pinegrass	Low	Insufficient data	No timber values
03	11	Dry soil, Nutrients	Low	Medium[f] (19, Fd)	Low - pinegrass, dry shrub, fireweed	Mod.	H forest floor displacement hazard on moderate slopes	Partial cutting recommended; seed banking species prolific after fire; Conserve limited organic matter on moderate and steeper slopes
04	5	Dry soil, Cold soil, Cold air temp., Nutrients (on >30% slopes)	No data	No data	Medium - pinegrass, dry alder	Mod.	.....	.....
01	40	Cold air temp., Cold soil, Dry soil, Nutrients (on >30% slopes)	Low	Medium (20, Fd)	Medium - mixed shrub, fireweed	Mod.	H forest floor displacement hazard on all sites; H mass wasting hazard on moderate slopes	Conserve limited organic matter; Special road construction/maintenance on moderate and steeper slopes

05	15	Cold soil, Cold air temp.	Med.	Good (22, Fd)	Medium - mixed shrub, fireweed	High	-----	Flat sites frost prone
06	12	Vegetation, Cold air temp., Cold soil	Med.	No data	High - mixed shrub, fern, wet alder	High	-----	Windthrow hazard; Water table may rise post-harvest; Flat sites frost prone; Partial cutting questionable; Riparian
07	2	Cold air temp., Vegetation, Cold soil	No data	No data	High - wet alder, mixed shrub, fern	High	Insufficient data	No timber values; Random machine travel on snowpack if silty, clayey, or organic; Riparian
08	2	Moisture, Cold air temp., Cold soil	Non-forest, fen	n.a.	Medium - sedges	High	H compaction and displacement hazard on organic soils	No timber values; Riparian

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[a] **Caution:** Based on sample plot data; some interpretations expected to vary with individual site conditions. Use of original interpretive tools is necessary; these interpretations are presented here to "red flag" common concerns. This table outlines key considerations that should go into management decisions. Rationale and interpretive tools are discussed in Section 3.6.

[b] These include air temperature, soil temperature, vegetation, soil moisture, and soil nutrients; use of SYTEPREP recommended, see Section 3.6.1.

[c] Complexes described in Newton and Comeau (1990).

[d] **Caution:** This is presented here to "red flag" common drainage needs and is not intended to substitute for site specific engineering interpretations, see Section 3.6.4.

[e] **Caution:** Site sensitivity keys must be used with your site data for the PHSP; see Section 3.6.5. H = high, 30 - 45% = moderate slope.

[f] Sample size less than five plots for site index determination.

ICHmw1

Variant Summary

Golden Moist Warm Interior Cedar - Hemlock Variant

Location: Mid to lower elevations in the Rocky Mountains from the Kickinghorse to the Sullivan river, and northern Selkirk Mountains from Parson to Gold River.

Elevation range: 750 to 1550 m (south aspect); 750 to 1500 m (north aspect).

Climate: Moist Climatic Region; no climate data. The ICHmw1 is likely wetter than the ICHmk1; drier than the ICHwk1; and warmer and drier than ESSFwm.

Soils, geology, and landforms: Limestone and shale are the main bedrock types in the Rocky Mountain Trench and Selkirk Mountain areas of the ICHmw1. These rock types, in addition to quartzite, phyllite, sandstone, and conglomerate, are also found in the Purcell Mountain areas of this variant. Morainal soils with silty to clayey surface textures occur on all slope positions. Glaciofluvial soils with silty or sandy surface textures are found on toe slopes. Glaciolacustrine soils with loamy or clayey textures and fluvial soils with loamy textures occur on level slopes. Limited areas of colluvial soils with silty to sandy textures occur on the steepest slopes. Some landforms are covered by a shallow deposit of silty eolian material.

Zonal vegetation: Climax zonal sites have stands of Hw and Cw. Seral stands of Sxw, Bl, and Fd are common. Hw and Cw occur as subdominants in seral stands. Common shrubs include falsebox, false azalea, and western yew. A sparse herb layer includes queen's cup and bunchberry. Red-stemmed feathermoss and knight's plume moss are prevalent.

Distinguishing the ICHmw1 from adjacent subzones/variants

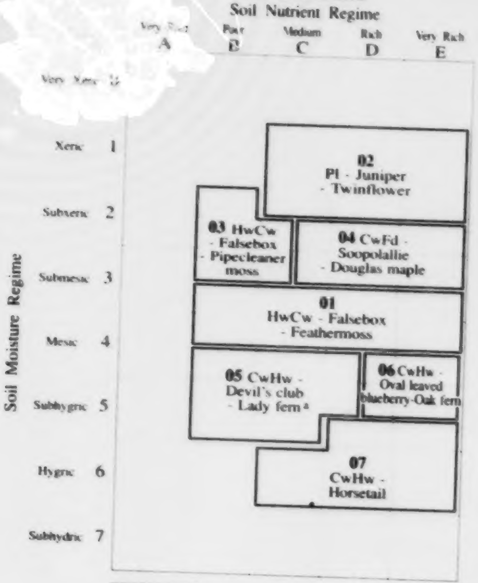
In the **ICHwk1** most sites have:	- less Pl, Pw, and Fd
zonal sites also have:	- more devil's club and oak fern
dry sites have:	- no common juniper, tall Oregon-grape, baldhip rose, round-leaved alumroot, pinegrass, or juniper haircap moss
In the **ICHmk1** most sites have:	- no Pw, Hw, western yew, oval-leaved blueberry, or cladinas - more heart-leaved arnica, pinegrass, and racemose pussytoes
In the **ESSFwm** most sites have:	- more false azalea - less Fd, Pw, Cw, Hw, Douglas maple, paper birch, saskatoon, red-osier dogwood, tall Oregon-grape, western yew, baldhip rose, highbush-cranberry, soopolallie, birch-leaved spirea, prince's pine, wild sarsaparilla, Hooker's fairybells, pink wintergreen, electrified cat's-tail moss, and step moss
dry sites have:	- no common juniper, kinnikinnick, parsley fern, round-leaved alumroot, pinegrass, or reindeer lichen

Forest characteristics: Moderate fire return periods have led to a mosaic of climax and seral stands.

Wildlife habitat: Valley bottom sites are important winter range for moose and elk, and form an important component adjacent to the Columbia River marshes. Snags are important to cavity-nesting birds.

ICHmw1

Edatopic Grid



Soil Nutrient Regime
Very Poor
A
Poor
B
Medium
C
Rich
D
Very Rich
E
Soil Moisture Regime
Very Xeric 0
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02 Pl - Juniper - Twinflower
03 HwCw - Falsebox - Pipecleaner moss
04 CwFd - Soopolallie - Douglas maple
01 HwCw - Falsebox - Feathermoss
05 CwHw - Devil's club - Lady fern [a]
06 CwHw - Oval leaved blueberry-Oak fern
07 CwHw - Horsetail

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[a] Lady fern uncommon in this site series.

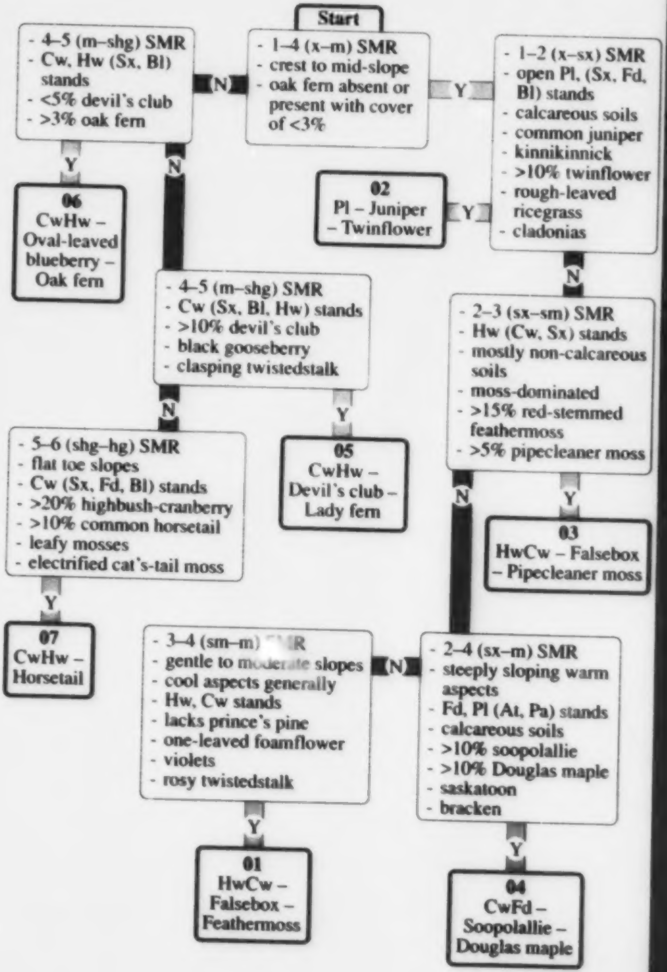
ICHmw1 Vegetation Table

	Site Series	02	03	04	01	05	06	07	
TREES	*Pinus contorta*	15 - 25%		7 - 15%					lodgepole pine
	Populus tremuloides			1 - 7%					trembling aspen
	Pinus albicaulis			1 - 7%					whitebark pine
	Pseudotsuga menziesii	1 - 7%		>25%	1 - 7%	7 - 15%			Douglas-fir
	Picea glauca x engelmannii	15 - 25%	1 - 7%		1 - 7%	1 - 7%	7 - 15%	15 - 25%	hybrid white spruce
	Abies lasiocarpa	1 - 7%	1 - 7%		1 - 7%	1 - 7%	7 - 15%	7 - 15%	subalpine fir
	Thuja plicata	<1%	7 - 15%		15 - 25%	>25%	>25%	>25%	western redcedar
	Tsuga heterophylla	<1%	>25%	<1%	>25%	1 - 7%	>25%		western hemlock
SHRUBS	*Juniperus communis*	15 - 25%							common juniper
	Shepherdia canadensis	1 - 7%		15 - 25%					soopolallie
	Spiraea betulifolia			7 - 15%					birch-leaved spirea
	Amelanchier alnifolia			1 - 7%					saskatoon
	Rosa woodsii				<1%				prairie rose
	Taxus brevifolia		7 - 15%		1 - 7%		<1%		western yew
	Paxistima myrsinites	<1%	15 - 25%	>25%	1 - 7%	<1%	<1%	1 - 7%	falsebox
	Menziesia ferruginea		1 - 7%		1 - 7%	<1%	7 - 15%		false azalea
	Acer glabrum			15 - 25%		<1%		1 - 7%	Douglas maple
	Vaccinium ovalifolium					<1%	15 - 25%	<1%	oval-leaved blueberry
	Oplopanax horridus					15 - 25%	1 - 7%	<1%	devil's club
	Cornus stolonifera					<1%		15 - 25%	red-osier dogwood
	Viburnum edule							1 - 7%	highbush-cranberry
HERBS	*Linnaea borealis*	>25%	<1%		<1%	<1%	<1%	1 - 7%	twinflower
	Arctostaphylos uva-ursi	15 - 25%							kinnikinnick
	Oryzopsis asperifolia	1 - 7%							rough-leaved ricegrass
	Chimaphila umbellata	<1%	<1%	1 - 7%					prince's pine
	Clintonia uniflora		<1%		1 - 7%	1 - 7%	1 - 7%		queen's cup
	Pteridium aquilinum			1 - 7%					bracken
	Disporum hookerii			1 - 7%				1 - 7%	Hooker's fairybells
	Cornus canadensis	1 - 7%	1 - 7%		1 - 7%	1 - 7%	1 - 7%	1 - 7%	bunchberry
	Gymnocarpium dryopteris					7 - 15%	15 - 25%		oak fern
	Aralia nudicaulis			1 - 7%		<1%	1 - 7%	15 - 25%	wild sarsaparilla
	Tiarella trifoliata var. unifoliata					7 - 15%	7 - 15%		one-leaved foamflower
	Mitella nuda					<1%		1 - 7%	common mitrewort
	Equisetum arvense							>25%	common horsetail
	Galium triflorum							1 - 7%	sweet-scented bedstraw
MOSSES AND LICHENS	*Cladonia spp.*	7 - 15%							cladonias
	Pleurozium schreberi	15 - 25%	>25%	<1%	>25%	1 - 7%	15 - 25%		red-stemmed feathermoss
	Rhytidiopsis robusta		15 - 25%	<1%	<1%	<1%	1 - 7%		pipecleaner moss
	Ptilium crista-castrensis		15 - 25%	1 - 7%	7 - 15%	15 - 25%	15 - 25%	7 - 15%	knight's plume
	Hylocomium splendens	7 - 15%	1 - 7%		1 - 7%	1 - 7%		7 - 15%	step moss
	Mnium spp.				<1%	1 - 7%	1 - 7%	>25%	leafy mosses

Approximate Cover Classes: ▫ <1% ▭ 1 - 7% ▭ 7 - 15% ▭ 15 - 25% ▭ >25%

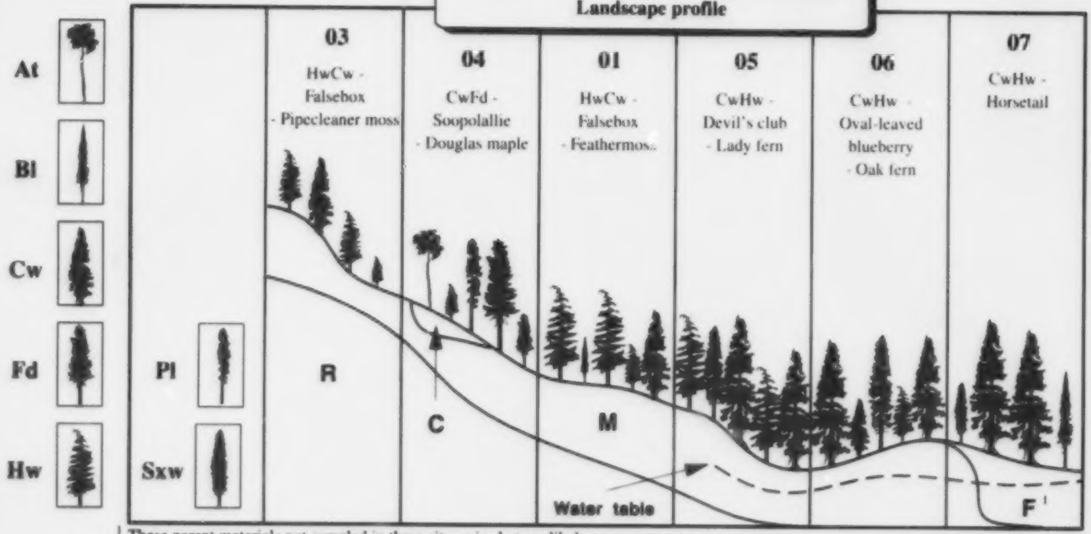
ICHmw1

Site Series Flowchart


Start
- 1–4 (x–m) SMR
- crest to mid-slope
- oak fern absent or present with cover of <3%
Y
- 1–2 (x–sx) SMR
- open Pl, (Sx, Fd, Bl) stands
- calcareous soils
- common juniper
- kinnikinnick
- >10% twinflower
- rough-leaved ricegrass
- cladonias
Y
02
Pl – Juniper – Twinflower
N
- 2–3 (sx–sm) SMR
- Hw (Cw, Sx) stands
- mostly non-calcareous soils
- moss-dominated
- >15% red-stemmed feathermoss
- >5% pipecleaner moss
Y
03
HwCw – Falsebox – Pipecleaner moss
N
- 2–4 (sx–m) SMR
- steeply sloping warm aspects
- Fd, Pl (At, Pa) stands
- calcareous soils
- >10% soopolallie
- >10% Douglas maple
- saskatoon
- bracken
Y
04
CwFd – Soopolallie – Douglas maple
N
- 3–4 (sm–m) SMR
- gentle to moderate slopes
- cool aspects generally
- Hw, Cw stands
- lacks prince's pine
- one-leaved foamflower
- violets
- rosy twistedstalk
Y
01
HwCw – Falsebox – Feathermoss
N
- 4–5 (m–shg) SMR
- Cw, Hw (Sx, Bl) stands
- <5% devil's club
- >3% oak fern
Y
06
CwHw – Oval-leaved blueberry – Oak fern
N
- 4–5 (m–shg) SMR
- Cw (Sx, Bl, Hw) stands
- >10% devil's club
- black gooseberry
- clasping twistedstalk
Y
05
CwHw – Devil's club – Lady fern
N
- 5–6 (shg–hg) SMR
- flat toe slopes
- Cw (Sx, Fd, Bl) stands
- >20% highbush-cranberry
- >10% common horsetail
- leafy mosses
- electrified cat's-tail moss
Y
07
CwHw – Horsetail

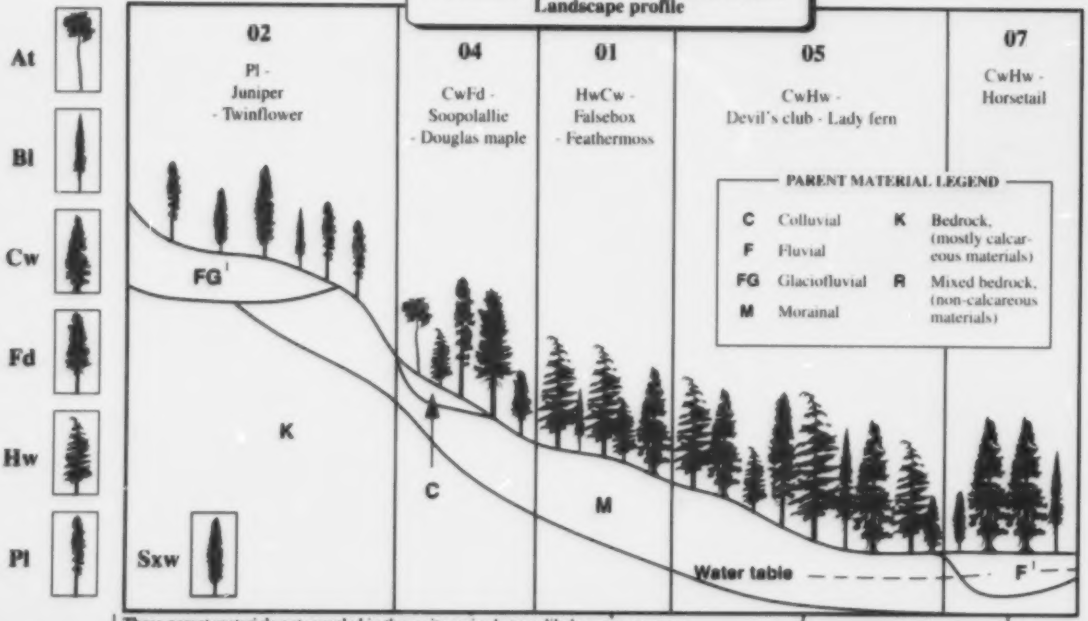
Y = Yes; N = No

ICHmw1 (non-calcareous bedrock)
Landscape profile


At
Bl
Cw
Fd
Hw
Pl
Sxw
03
HwCw - Falsebox - Pipecleaner moss
04
CwFd - Soopolallie - Douglas maple
01
HwCw - Falsebox - Feathermoss
05
CwHw - Devil's club - Lady fern
06
CwHw - Oval-leaved blueberry - Oak fern
07
CwHw - Horsetail
R
C
M
Water table
F[1]

[1] These parent materials not sampled in these site series but are likely more common.

ICHmw1 (calcareous bedrock)
Landscape profile


At
Bl
Cw
Fd
Hw
Pl
Sxw
02
Pl - Juniper - Twinflower
04
CwFd - Soopolallie - Douglas maple
01
HwCw - Falsebox - Feathermoss
05
CwHw - Devil's club - Lady fern
07
CwHw - Horsetail
PARENT MATERIAL LEGEND
C Colluvial
F Fluvial
FG Glaciofluvial
M Morainal
K Bedrock, (mostly calcareous materials)
R Mixed bedrock, (non-calcareous materials)
FG[1]
K
C
M
Water table
F[1]

[1] These parent materials not sampled in these site series but are likely more common.

ICHmw1 Environmental Table

Site series		02	03	04	01	05	06	07
Number of plots		2	5	2	15	4	5	1
Soil moisture regime[a] (SMR)		1-2 x-sx	2-3(4)[b] sx-sm(m)	2-4 sx-m	(2)3-4(5) (sx)sm-m(shg)	(3)4-5 (sm)m-shg	(3)4-5 (sm)m-shg	5 shg
Aspect		flat to warm	variable	warm	mostly cool or neutral	cool	variable	n.a.
Slope gradient %		variable	0-35	50-65	0-30	5-25	5-35	flat
Slope position		crest-upper	crest-mid (lower)	mid	(upper)-mid	mid-level	lower	toe
Parent material		F,L	M	C,M	M(FG,D)	M(F,L,D)	variable	FG
Soil texture coarse fragments % (min.-**mean**-max.)	0-30 cm	L 25-**38**-50	L 10-**10**-10	no data	S,L(C) 10-**31**-50	C 15-**15**-15	L,C 0-**23**-50	no data
	30+ cm	C,S 10-**38**-65	L 35-**35**-35	no data	C,L(S) 25-**54**-80	C 15-**15**-15	L,C 0-**43**-70	no data
Humus form — LFH thickness cm (min.-**mean**-max.)		Moder, Mor 2-**4**-6	Mor 4-**7**-10	Mor 2-**2**-3	Mor 2-**8**-20	Mor 3-**4**-10	Mor 5-**10**-16	Mor 28
Important site features		calcareous; presumably occurs on other parent materials	mostly non-calcareous	calcareous; seral sites	—	may be found on submesic sites in narrow valleys and on sites with deep rotten wood	mostly non-calcareous; may be found on submesic sites in narrow valleys and on sites with deep rotten wood	presumably found on F parent material

[a] Environmental features contained in this table are defined in Section 3.4.4.

[b] Values in brackets less common.

ICHmw1

Management Interpretations[a]

Site series	Number of plots	Common seedling growth limiting factors[a,b]	Relative tree productivity		Vegetation potential - common complexes[c]	Road drainage control needs (see cautions[a,c])	Common site sensitivities (see cautions[a,e])	Other prescription considerations
			Gross volume productivity	Growth class (site index, tree species)				
02	2	Dry soil, Nutrients	Med.	Good (19, Sxw)	Low - fireweed	Low	H forest floor displacement hazard on all sites; H surface erosion and mass wasting hazard on very steep slopes; H displacement hazard on moderate slopes	Conserve limited organic matter; Special road construction /maintenance on steep slopes
03	3	-	High	Good (18, Sxw)	Low - fireweed, mixed shrub	Mod.	Insufficient data	-
04	2	-	No data	No data	Medium - dry shrub, fireweed, mixed hardwood	Mod.	Insufficient data	-

01	15	Cold soil	High	Good (18, Sxw)	Medium - mixed shrub, fireweed, mixed hardwood	Mod.	H compaction hazard on silty soils	Flat sites frost prone; Random machine traffic on silty soils on snowpack or when dry
05	4	Cold air temp. Vegetation, Nutrients (on clay soils)	High	Good (23, Sxw)	High - mixed shrub, fireweed	High	H forest floor displacement hazard on clayey soils	Flat sites frost prone; Conserve organic matter on clayey soils
06	5	Cold air temp. Vegetation, Cold soil temp., Nutrients	High	Good (18, Sxw)	Medium - mixed shrub, fireweed	High	H forest floor displacement hazard on all sites	Frost prone sites; Conserve limited organic matter
07	1	Cold air temp., Cold soil temp., Vegetation	No data	No data	Medium - mixed shrub	High	Insufficient data	Riparian

---

[a] **Caution:** Based on sample plot data; some interpretations expected to vary with individual site conditions. Use of original interpretive tools is necessary; these interpretations are presented here to "red flag" common concerns. This table outlines key considerations that should go into management decisions. Rationale and interpretive tools are discussed in Section 3.6.

[b] These include air temperature, soil temperature, vegetation, soil moisture, and soil nutrients; use of SYTEPREP recommended, see Section 3.6.1.

[c] Complexes described in Newton and Comeau (1990).

[d] **Caution:** This is presented here to "red flag" common drainage needs and is not intended to substitute for site specific engineering interpretations, see Section 3.6.4.

[e] **Caution:** Site sensitivity keys must be used with your site data for the PHSP; see Section 3.6.5.

H = high, 30 - 45% = moderate slope, 45 - 60% = steep slope, >60% = very steep slope.

ICHmw2

Variant Summary

Columbia - Shuswap Moist Warm Interior Cedar - Hemlock Variant

Location: Southern Monashee, Selkirk, and Purcell mountains; valley bottoms and mid to lower slopes of Upper Arrow Lake, Trout Lake, Lardeau River, and upper St. Mary's River valleys; mid-slope positions above the ICHdw in the upper Granby river, Lower Arrow Lake, Columbia River, Slocan Valley, Kootenay Valley, Goat River, and southern Moyie river. This variant is also found extensively in the Kamloops Forest Region.

Elevation range: 500 to 1450 m (in the northern end of its range) and 1200 to 1450 m (where it is found above the ICHdw).

Climate[39]**:** Moist Climatic Region; hot, moist summers; very mild winters with light snowfall. Soils dry out for moderate to nonexistent time periods in late summer. Snowpacks are generally of moderate depth and duration, which, combined with the mild climate, prevents soils from freezing to any significant depth, with the exception of some bladed soils. Climate is not a major limitation to growth on zonal sites, with moisture becoming limiting on dry sites and frost becoming limiting on some depressional sites.

Soils, geology, and landforms: The ICHmw2 covers several physiographic regions. Thus a wide variety of bedrock is found in this variant. Morainal soils with loamy or silty surface textures occur on lower to upper slopes. Glaciofluvial soils with loamy, silty, or sandy soils are found in proximity to morainal soils. Morainal and glaciofluvial soils sometimes have strongly contrasting textures at depth. Some soils are covered by silty loess deposits in the southern part of the variant. Fluvial soils with loamy, silty, or sandy textures are found on lower and level slopes. On steep, upper slopes, colluvial soils with sandy, loamy, or silty textures occur. Organic soils occupy wet depressional areas.

Zonal vegetation: Climax zonal sites have stands of Hw and Cw. However, mixed seral stands of Fd, Lw, Sxw, Hw, and Cw are more common. Falsebox and black huckleberry are common shrubs. Herbs consist of twinflower, prince's pine, queen's cup, and one-leaved foamflower. Red-stemmed feathermoss, pipecleaner moss, and step moss are prevalent.

Distinguishing the ICHmw2 from adjacent subzones/variants

In the **ICHdw** most sites have:	- Bg - less Bl and Sxw
zonal sites also have:	- shrub-dominated rather than moss-dominated vegetation
dry sites have:	- Py and ocean-spray
In the **ICHwk1** most sites have:	- less Lw, Pl, Pw, and Fd
zonal sites have:	- devil's club and oak fern
dry sites have:	- no round-leaved alumroot, common juniper, pinegrass, tall Oregon-grape, baldhip rose, or juniper haircap moss
In the **ICHmk1** most sites have:	- no Pw, Hw, or western yew
dry sites have:	- more heart-leaved arnica, pinegrass, and racemose pussytoes
wet sites have:	- no oval-leaved blueberry
In the **ICHmw3** most sites have:	- no Lw - more knight's plume - less Utah honeysuckle

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[39] Values for climate descriptors given in Appendix 12.

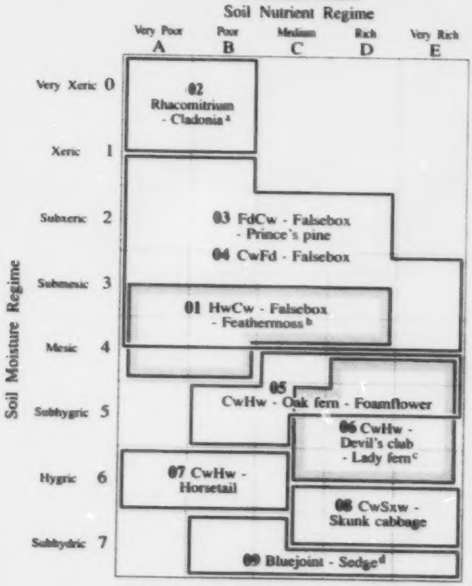
In the **ESSFwc1** most sites have:-	- white flowered rhododendron - less Douglas maple, paper birch, wild sarsaparilla, Hooker's fairybells, western yew, electrified cat's-tail moss, baldhip rose, prince's pine, step moss, and pink wintergreen
dry sites have:	- no common juniper, kinnikinnick, round-leaved alumroot, pinegrass, parsley fern, or cladinas - less saskatoon, tall Oregon-grape, soopolallie, and birch-leaved spirea
wet sites have:	- less red-osier dogwood and high-bush cranberry

Forest characteristics: Recurrent fires have led to a mosaic of climax and seral stands.

Wildlife habitat: These forests historically supported an old-growth dependent wildlife community, where fire had not affected the forest extensively. Early seral stages provide important forage to a wide variety of species, including grizzly bear, deer, moose, and elk.

ICHmw2

Edatopic Grid


Soil Nutrient Regime
Very Poor A
Poor B
Medium C
Rich D
Very Rich E
Soil Moisture Regime
Very Xeric 0
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02 Rhacomitrium - Cladonia a
03 FdCw - Falsebox - Prince's pine
04 CwFd - Falsebox
01 HwCw - Falsebox - Feathermoss b
05 CwHw - Oak fern - Foamflower
06 CwHw - Devil's club - Lady fern c
07 CwHw - Horsetail
08 CwSxw - Skunk cabbage
09 Bluejoint - Sedge d

Shading used where considerable site series overlap occurs.

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[a] Not recognized in Lloyd *et al.* (1990). All site series numbers differ by one from Lloyd *et al.* (1990).

[b] 01 - YS in Lloyd *et al.* (1990) not recognized.

[c] Referred to as CwHw - Devil's club - Sarsaparilla in Lloyd *et al.* (1990).

[d] Referred to as Bluejoint - Glow moss in Lloyd *et al.* (1990)

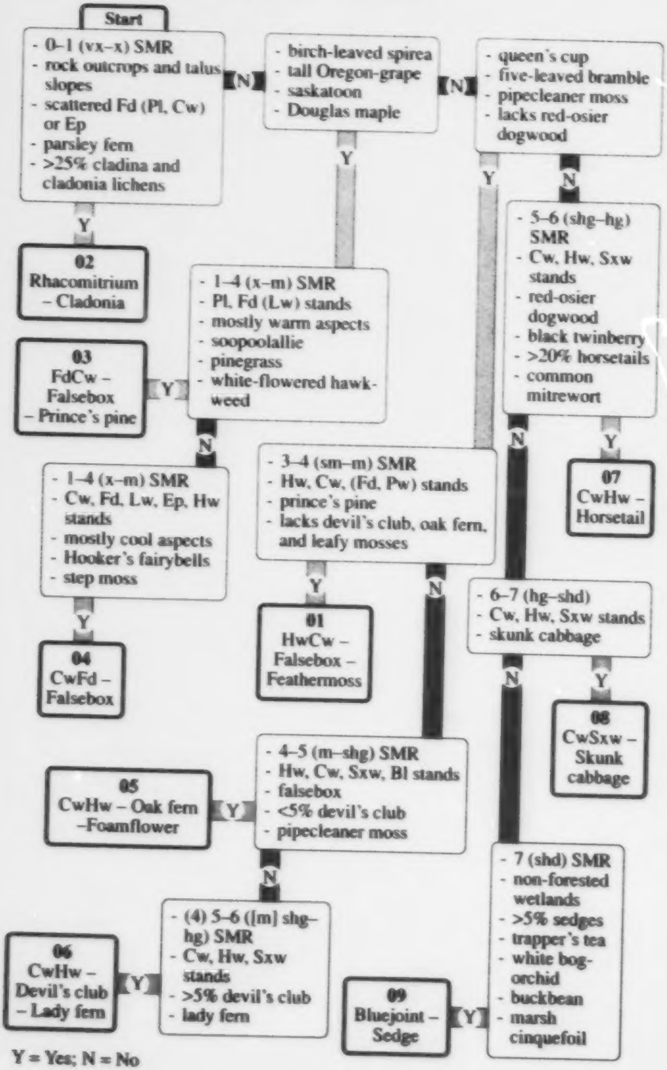
ICHmw2 Vegetation Table

	Site Series	02	03	04	01	05	06	07	08	09	
TREES	*Pinus contorta*	<1%	15 - 25%	<1%							lodgepole pine
	Pseudotsuga menziesii	1 - 7%	15 - 25%	>25%	1 - 7%	<1%	<1%				Douglas-fir
	Larix occidentalis		7 - 15%	1 - 7%	<1%						western larch
	Thuja plicata	<1%	7 - 15%	>25%	15 - 25%	>25%	>25%	>25%	>25%	1 - 7%	western redcedar
	Tsuga heterophylla		1 - 7%	7 - 15%	>25%	>25%	>25%	>25%	>25%	<1%	western hemlock
	Picea engelmannii x glauca		<1%	1 - 7%	<1%	1 - 7%	7 - 15%	7 - 15%	7 - 15%	1 - 7%	hybrid white spruce
SHRUBS	*Amelanchier alnifolia*	<1%	1 - 7%								saskatoon
	Shepherdia canadensis		15 - 25%								soopolallie
	Spiraea betulifolia		7 - 15%	<1%							birch-leaved spirea
	Paxistima myrsinites		15 - 25%	7 - 15%	7 - 15%	1 - 7%					falsebox
	Vaccinium membranaceum		1 - 7%	<1%	1 - 7%	7 - 15%	1 - 7%	<1%	<1%		black huckleberry
	Lonicera utahensis		1 - 7%	<1%	<1%	<1%	<1%				Utah honeysuckle
	Oplopanax horridus					<1%	15 - 25%		15 - 25%		devil's club
	Vaccinium ovalifolium					1 - 7%	1 - 7%	1 - 7%	1 - 7%		oval-leaved blueberry
	Ribes lacustre						<1%	1 - 7%	1 - 7%		black gooseberry
	Cornus stolonifera							7 - 15%	<1%		red-osier dogwood
	Lonicera involucrata							<1%	<1%	<1%	black twinberry
HERBS	*Cryptogramma crispa*	1 - 7%									parsley fern
	Chimaphila umbellata		7 - 15%	1 - 7%	1 - 7%			<1%			prince's pine
	Linnaea borealis		15 - 25%	7 - 15%	1 - 7%	<1%	<1%	1 - 7%	1 - 7%		twinflower
	Orthilia secunda		<1%	<1%	<1%	<1%			<1%		one-sided wintergreen
	Clintonia uniflora		<1%	<1%	1 - 7%	7 - 15%	7 - 15%		1 - 7%		queen's cup
	Rubus pedatus				<1%	7 - 15%	7 - 15%				five-leaved bramble
	Dryopteris expansa					<1%	1 - 7%				spiny wood fern
	Actaea rubra					<1%	<1%				baneberry
	Tiarella trifoliata var. unifoliata				1 - 7%	15 - 25%	15 - 25%	1 - 7%	15 - 25%		one-leaved foamflower
	Gymnocarpium dryopteris					>25%	>25%		1 - 7%	<1%	oak fern
	Streptopus amplexifolius					<1%	<1%		1 - 7%		clasping twistedstalk
	Athyrium filix-femina					1 - 7%	15 - 25%		15 - 25%		lady fern
	Equisetum arvense							15 - 25%	1 - 7%		common horsetail
	Osmorhiza chilensis							<1%	<1%		mountain sweet-cicely
	Lysichiton americanum								>25%		skunk cabbage
	Carex spp.								<1%	1 - 7%	sedges
	Potentilla palustris									1 - 7%	marsh cinquefoil
	Platanthera dilatata									<1%	white bog-orchid
	Calamagrostis canadensis									7 - 15%	bluejoint
MOSSES AND LICHENS	*Rhacomitrium spp.*	>25%									rock mosses
	Cladonia spp.	>25%									cladonias
	Rhytidiopsis robusta		<1%	1 - 7%	15 - 25%	15 - 25%	1 - 7%				pipecleaner moss
	Pleurozium schreberi		15 - 25%	15 - 25%	15 - 25%	1 - 7%	1 - 7%	7 - 15%	<1%		red-stemmed feathermoss
	Mnium spp.			<1%		1 - 7%	7 - 15%	15 - 25%	>25%	<1%	leafy mosses

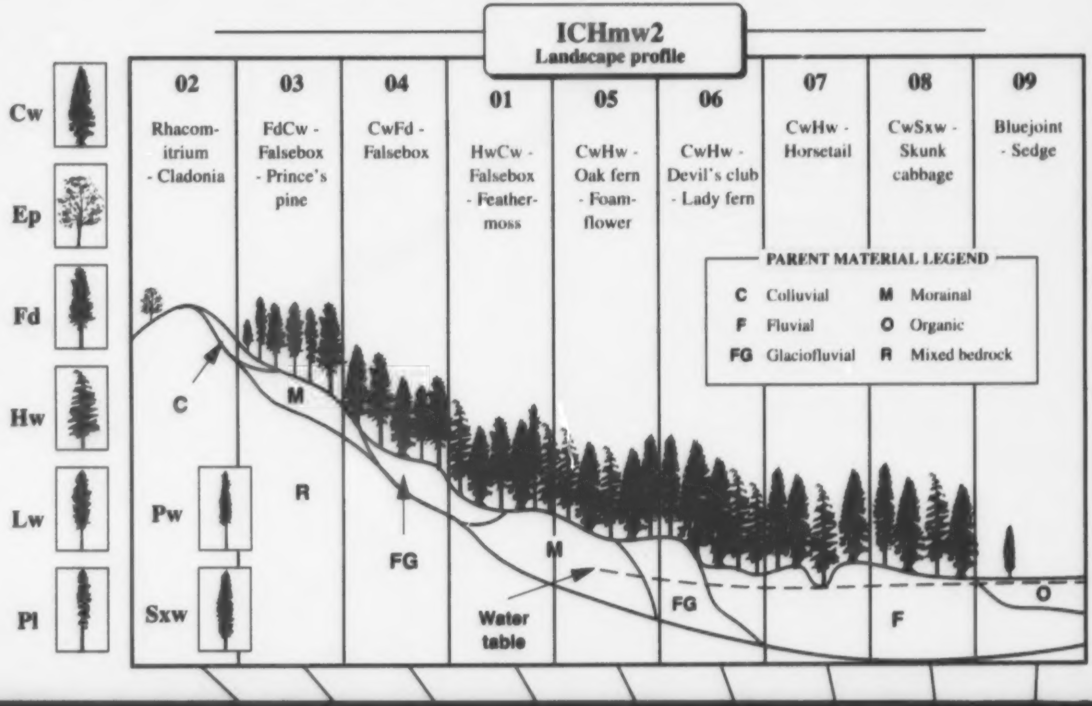
Approximate Cover Classes: <1%, 1 - 7%, 7 - 15%, 15 - 25%, >25%

ICHmw2

Site Series Flowchart


Start
- 0–1 (vx–x) SMR
- rock outcrops and talus slopes
- scattered Fd (Pl, Cw) or Ep
- parsley fern
- >25% cladina and cladonia lichens
N
- birch-leaved spirea
- tall Oregon-grape
- saskatoon
- Douglas maple
N
- queen's cup
- five-leaved bramble
- pipecleaner moss
- lacks red-osier dogwood
Y
02 Rhacomitrium – Cladonia
Y
Y
N
- 5–6 (shg–hg) SMR
- Cw, Hw, Sxw stands
- red-osier dogwood
- black twinberry
- >20% horsetails
- common mitrewort
- 1–4 (x–m) SMR
- Pl, Fd (Lw) stands
- mostly warm aspects
- soopoolallie
- pinegrass
- white-flowered hawkweed
03 FdCw – Falsebox – Prince's pine
Y
N
N
Y
07 CwHw – Horsetail
- 1–4 (x–m) SMR
- Cw, Fd, Lw, Ep, Hw stands
- mostly cool aspects
- Hooker's fairybells
- step moss
- 3–4 (sm–m) SMR
- Hw, Cw, (Fd, Pw) stands
- prince's pine
- lacks devil's club, oak fern, and leafy mosses
Y
Y
N
- 6–7 (hg–shd)
- Cw, Hw, Sxw stands
- skunk cabbage
04 CwFd – Falsebox
01 HwCw – Falsebox – Feathermoss
N
Y
08 CwSxw – Skunk cabbage
05 CwHw – Oak fern –Foamflower
Y
- 4–5 (m–shg) SMR
- Hw, Cw, Sxw, Bl stands
- falsebox
- <5% devil's club
- pipecleaner moss
N
- 7 (shd) SMR
- non-forested wetlands
- >5% sedges
- trapper's tea
- white bog-orchid
- buckbean
- marsh cinquefoil
06 CwHw – Devil's club – Lady fern
Y
- (4) 5–6 ([m] shg–hg) SMR
- Cw, Hw, Sxw stands
- >5% devil's club
- lady fern
09 Bluejoint – Sedge
Y

Y = Yes; N = No


ICHmw2
Landscape profile
Cw
Ep
Fd
Hw
Lw
Pl
02
Rhacom-itrium - Cladonia
03
FdCw - Falsebox - Prince's pine
04
CwFd - Falsebox
01
HwCw - Falsebox - Feather-moss
05
CwHw - Oak fern - Foam-flower
06
CwHw - Devil's club - Lady fern
07
CwHw - Horsetail
08
CwSxw - Skunk cabbage
09
Bluejoint - Sedge
PARENT MATERIAL LEGEND
C Colluvial
F Fluvial
FG Glaciofluvial
M Morainal
O Organic
R Mixed bedrock
C
M
R
FG
M
FG
F
O
Pw
Sxw
Water table

ICHmw2 Environmental Table

Site series		02	03	04	01	05	06	07	08	09
Number of plots		2	27	16	65	40	24	3	8	6
Soil moisture regime[a] (SMR)		0-1 vx-x	(1)[b]2-4 (x)sx-m	(1)2-4 (x)sx-m	3-4 sm-m	4-5 m-shg	5-6(4) shg-hg	6 hg	6-7 hg-shd	7 shd
Aspect		variable	mostly warm	cool	variable	cool	variable	n.a.	n.a.	n.a.
Slope gradient %		variable	variable	variable	variable	variable	0-20	0	0-6	0
Slope position		variable	variable	variable	mid-lower, level	lower-mid, level	lower-mid, level	level	toe-level, dep.	level, dep.
Parent material		C,R	M,FG(C,F)	FG,M	M,FG,F,C	M,F,FG	F(M,FG)	F	F(M,L)	O
Soil texture coarse fragments % (min.-**mean**-max.)	0-30 cm	non-soil	L($) 10-**39**-60	L(S) 63-**66**-65	L($) 4-**30**-60	L$(S) 6-**35**-65	$,L(S) 0-**23**-50	no data	$ 0	organic (L) 0
	30+ cm	non-soil	L(S) 35-**60**-77	S(L) 65-**74**-90	S,L(C,$) 25-**54**-80	L(S) 20-**52**-77	L(S,$) 12-**41**-68	no data	no data	organic (L) 0
Humus form — LFH thickness cm (min.-**mean**-max.)		— 0	Mor (Moder) 1-**5**-18	Mor (Moder) 4-**7**-15	Mor, Moder 3-**6**-14	Moder, Mor 1-**8**-23	Moder, Mor 1-**8**-15	all 8-**16**-20	saturated Mull, Moder 16-**22**-30	organic soils
Important site features		talus slope or rock outcrop	—	restricting layers and colluvial veneers common	—	minor seepage; some F,C and L veneers	seepage 25-100 cm	water table 25-100 cm	seepage or water table 30 cm; some organic veneer	water table < 10 cm

[a] Environmental features contained in this table are defined in Section 3.4.4.

[b] Values in brackets less common.

ICHmw2

Management Interpretations[a]

Site series	Number of plots	Common seedling growth limiting factors[a,b]	Relative tree productivity		Vegetation potential - common complexes[c]	Road drainage control needs (see cautions[a,c])	Common site sensitivities (see cautions[a,e])	Other prescription considerations
			Gross volume productivity	Growth class (site index, tree species)				
02	2	Dry soil, Nutrients, Cold air temp.	n.a.	n.a.	Low - dry shrub	Low	H-VH displacement and forest floor displacement hazard on all sites; H surface erosion hazard on very steep slopes; H-VH mass wasting (dry ravelling) hazard on very steep slopes	No timber values; Conserve limited organic matter; Special road construction/maintenance on very steep slopes
03	27	Nutrients	Med.	Good (21, Fd)	Medium - dry shrub, fireweed	Mod.	H forest floor displacement hazard on all sites; H displacement hazard on steep slopes; H mass wasting hazard on very steep slopes	Partial cutting recommended; Conserve limited organic matter; Special road construction /maintenance on very steep slopes
04	16	Cold soil, Nutrients (on >60% slopes)	Med.	Good (21, Fd)	Low - fireweed, mixed shrub	Mod.	H displacement and forest floor displacement hazard on moderate slopes	Conserve limited organic matter on moderate and steeper slopes
01	65	Cold air temp., Nutrients (on >60% slopes)	High	Good (22, Fd)	Medium - mixed shrub, fireweed	Mod.	H forest floor displacement hazard on very steep slopes	Conserve limited organic matter on very steep slopes

05	40	Vegetation, Cold soil, Cold air temp., Nutrients (on >60% slopes)	High	Good (23, Fd)	Medium - mixed shrub, fireweed	High	H forest floor displacement hazard on moderate slopes	Conserve limited organic matter on moderate and steeper slopes
06	24	Vegetation, Cold air temp.	High	Good (23, Fd)	High - mixed shrub, fern	High	H compaction hazard on silty soils	Windthrow hazard; Water table may rise post-harvest; Partial cutting question; Random machine travel on snowpack; Riparian
07	3	Vegetation, Cold air temp.	No data	No data	Medium - mixed shrub,	High	Insufficient data	Windthrow hazard; Water table may rise post-harvest; Random machine travel on snowpack; Riparian
08	8	Vegetation, Cold air temp., Wet soil	Very high	Good (22, Fd)	High - mixed shrub, fern	High	Insufficient data	Windthrow hazard; Water table may rise post-harvest; Partial cutting questionable; Frost prone sites; Random machine travel on snowpack; Riparian
09	6	Wet soil, Cold air temp.	n.s.	n.s.	Medium - sedges	High	H compaction and displacement hazard on organic soils	No timber values; Riparian

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[a] **Caution**: Based on sample plot data; some interpretations expected to vary with individual site conditions. Use of original interpretive tools is necessary; these interpretations are presented here to "red flag" common concerns. This table outlines key considerations that should go into management decisions. Rationale and interpretive tools are discussed in Section 3.6.

[b] These include air temperature, soil temperature, vegetation, soil moisture, and soil nutrients; use of SYTEPREP recommended, see Section 3.6.1.

[c] Complexes described in Newton and Comeau (1990).

[d] **Caution**: This is presented here to "red flag" common drainage needs and is not intended to substitute for site specific engineering interpretations, see Section 3.6.4.

[e] **Caution**: Site sensitivity keys must be used with your site data for the PHSP; see Section 3.6.5.

VH = very high, H = high, 30 - 45% = moderate slope, 45 - 60% = steep slope, > 60% = very steep slope.

ICHmw3

Variant Summary

Thompson Moist Warm Interior Cedar - Hemlock Variant

Location: Valley floor and lower slopes from Galena Bay to Revelstoke along Upper Arrow Lake. West of Revelstoke this variant occurs on warm slopes along Highway 1 and up side drainages of the Columbia, such as the Akokolex River, and Crawford, Drimmie, Cranberry, Blanket, and Begbie creeks. The ICHmw3 can occur below either the ICHwk1 or ESSFwc1.

This subzone occurs more extensively in the Kamloops Forest Region. Please refer to A Guide to Site Identification and Interpretation for the Kamloops Forest Region" *(Lloyd* et al. *1990) for a detailed description of vegetation, environmental features, and management interpretations.*

Elevation range: 400 to 1400 m (south aspect); 400 to 1350 m (north aspect).

Distinguishing the ICHmw3 from adjacent subzones/variants

In the **ICHmw2** most sites have:	- Lw - more Utah honeysuckle - less knight's plume
In the **ICHwk1** most sites have:	- less Pl and Pw
zonal sites also have:	- high cover of oak fern
In the **ESSFwc1** most sites have:	- white-flowered rhododendron - more Bl - less Fd, Pw, Cw, Hw, paper birch, and prince's pine
dry sites have:	- no tall Oregon-grape, common juniper, or kinnikinnick - less soopolallie
wet sites have:	- Sitka valerian

ESSFwc1

Variant Summary

Columbia Wet Cold Engelmann Spruce - Subalpine Fir Variant

Location: Upper slopes in the Monashee and Selkirk mountains south of Revelstoke.

Elevation range: 1450 to 1650 m (south aspect); 1400 to 1600 m (north aspect).

Climate: Moist Climatic Region; no climate data. The ESSFwc1 is likely colder and wetter, with more snow than the ICH; warmer and drier, with less snow than the ESSFwm, ESSFwc4, and ESSFvc1; warmer and wetter, with more snow than the ESSFdc1.

Soils, geology, and landforms: Common rock types in the Selkirk Mountain areas of the ESSFwc1 include shale, argillite, quartzite, slate, granodiorite, and quartz diorite. In the Monashee Mountain area of the variant, rock types include gneiss, schist, gneissic granite, granodiorite, quartz diorite, basalt, and andesite. Morainal soils with loamy to silty surface textures occur on lower to upper slopes. These soils often have restricting layers below the surface. Fluvial soils with silty or loamy surface textures occur on lower to level slopes. Colluvial soils with silty textures are found on upper slopes. Organic soils commonly occur in depressional areas. Glaciofluvial soils with variable textures are found on toe and lower slope positions. Seepage is common on mid to lower slopes.

Zonal vegetation: Climax zonal stands have Se and Bl stands. Cw and Hw are often present in the understory or as intermediate trees. White-flowered rhododendron, black huckleberry, and Utah honeysuckle are the most common shrubs. Sites are often very shrubby. Herbs include five-leaved bramble, queen's cup, oak fern, and one-leaved foamflower. Red-stemmed feathermoss is abundant.

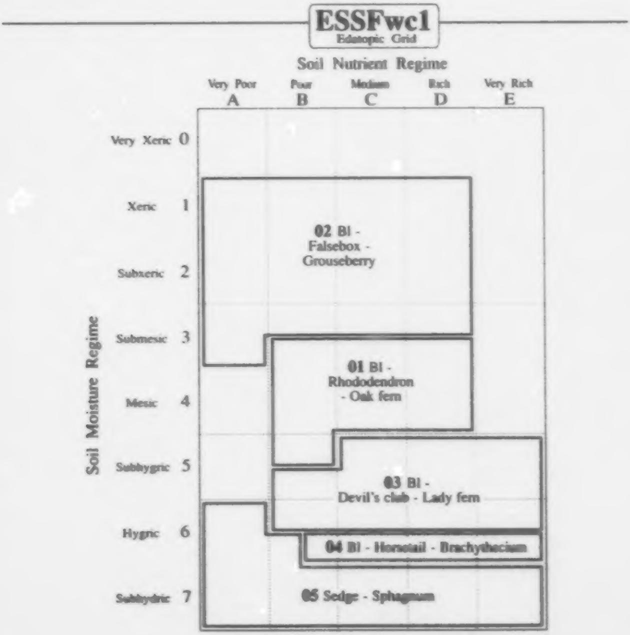
Distinguishing the ESSFwc1 from adjacent subzones/variants

In the **ESSFwc4** most sites have:	- more white-flowered rhododendron, small-flowered woodrush, and mountain hairgrass - no Hw or Cw; - less thimbleberry, sweet-scented bedstraw, false Solomon's-seal, and bunchberry
wet sites have:	- less devil's club and cow-parsnip
In the **ESSFvc** most sites have:	- Hm - no Pl - more false azalea and arrow-leaved groundsel - less falsebox, thimbleberry, Utah honeysuckle, and rattlesnake-plantain
dry sites have:	- partridgefoot
In the **ESSFwm** most sites have:	- more false azalea - less Cw and Hw
zonal sites also have:	- less thimbleberry, five-leaved bramble, and oval-leaved blueberry
In the **ICHmw2** most sites have:	- no white-flowered rhododendron - more Lw, Fd, Pw, Cw, Hw, western yew, paper birch, baldhip rose, wild sarsaparilla, Hooker's fairybells, prince's pine, pink wintergreen, electrified cat's-tail moss, and step moss
dry sites have:	- common juniper, saskatoon, tall Oregon-grape, birch-leaved spirea, soopolallie, kinnikinnick, parsley fern, round-leaved alumroot, pinegrass, and cladinas - more Douglas maple
wet sites have:	- red-osier dogwood and highbush-cranberry
In the **ICHwk1** most sites have:	- western yew, wild sarsaparilla, Hooker's fairybells, enchanter's nightshade, and step moss - no white-flowered rhododendron, Sitka alder, or common leafy liverwort

	more Pw, Hw, and Cw
wet sites have:	red-osier dogwood
In the ICHmk1 most sites have:	roses and round-leaved violet no white-flowered rhododendron, oval-leaved blueberry, spiny wood fern, Sitka valerian, or five-stamened mitrewort more Fd and Lw
dry sites have:	pinegrass
wet sites have:	red-osier dogwood no cow-parsnip

Forest characteristics: This low elevation ESSF variant occurs immediately above the ICH. Cw and Hw occur but rarely form part of the main tree canopy. Relatively long fire return periods have led to few seral stands. Stand replacement often occurs through insects, disease, and wind. Mountain pine beetle is prevalent in this variant. Although not often found in mature stands in this variant, large amounts of Sitka alder are found along roads and other disturbed areas. In the extreme southern Selkirks, south of Nelson, bear-grass may dominate the understory vegetation. This is likely indicative of a drier, warmer climate; however, due to the lack of sufficient sampling in this area, a separate unit has not been identified.

Wildlife habitat: Extensive old-growth forests support a range of dependent wildlife species. Maintenance of enough old growth to preserve these species is important. Maintenance of insect-feeding birds through preservation of snags and large woody debris will reduce the incidence of insect pest outbreaks.


ESSFwc1
Edatopic Grid
Soil Nutrient Regime
Very Poor A
Poor B
Medium C
Rich D
Very Rich E
Soil Moisture Regime
Very Xeric 0
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02 Bl - Falsebox - Grouseberry
01 Bl - Rhododendron - Oak fern
03 Bl - Devil's club - Lady fern
04 Bl - Horsetail - Brachythecium
05 Sedge - Sphagnum

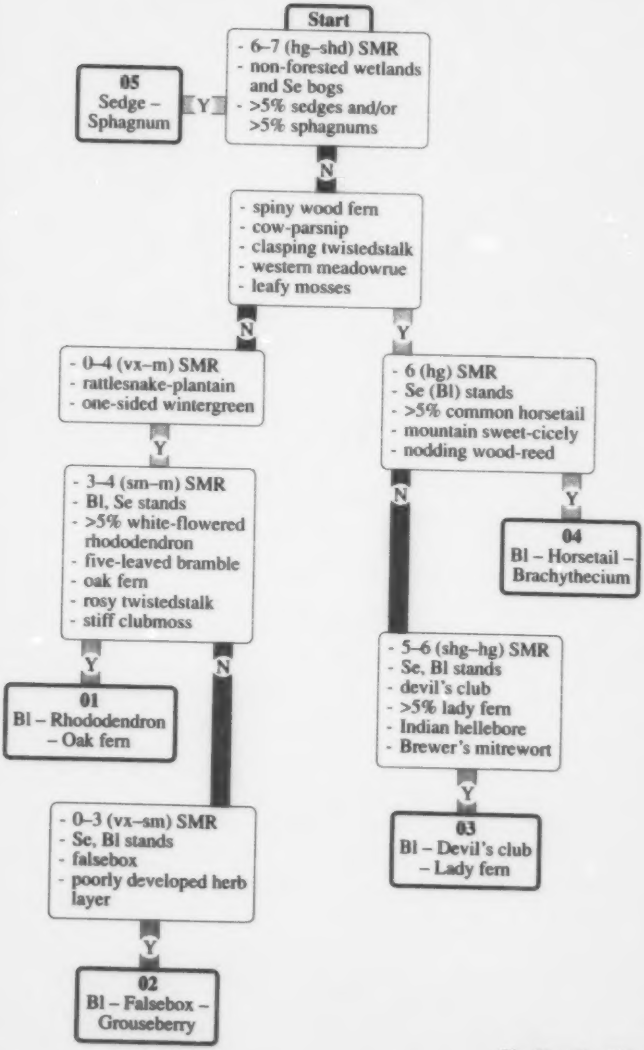
ESSFwc1 Vegetation Table

	Site Series	02	01	03	04	05	
TREES	*Pinus contorta*	1 - 7%	<1%				lodgepole pine
	Thuja plicata	<1%	<1%	<1%			western redcedar
	Tsuga heterophylla		1 - 7%		<1%		western hemlock
	Picea engelmannii	>25%	>25%	>25%	>25%	1 - 7%	Engelmann spruce
	Abies lasiocarpa	15 - 25%	>25%	15 - 25%	1 - 7%		subalpine fir
SHRUBS	*Paxistima myrsinites*	7 - 15%	<1%				falsebox
	Vaccinium membranaceum	7 - 15%	15 - 25%	15 - 25%	<1%		black huckleberry
	Lonicera utahensis	1 - 7%	7 - 15%	1 - 7%			Utah honeysuckle
	Ribes lacustre	1 - 7%	1 - 7%	7 - 15%	1 - 7%		black gooseberry
	Rhododendron albiflorum	1 - 7%	15 - 25%	1 - 7%			white-flowered rhododendron
	Rubus parviflorus	1 - 7%	<1%	1 - 7%	>25%		thimbleberry
	Lonicera involucrata	<1%		<1%	1 - 7%		black twinberry
	Vaccinium ovalifolium		1 - 7%	1 - 7%	<1%		oval-leaved blueberry
	Oplopanax horridus			1 - 7%	7 - 15%		devil's club
HERBS	*Vaccinium scoparium*	1 - 7%					grouseberry
	Orthilia secunda	1 - 7%	<1%				one-sided wintergreen
	Clintonia uniflora	<1%	15 - 25%	<1%			queen's cup
	Rubus pedatus	<1%	>25%	1 - 7%	1 - 7%		five-leaved bramble
	Gymnocarpium dryopteris		7 - 15%	>25%	<1%		oak fern
	Tiarella trifoliata var. unifoliata	<1%	7 - 15%	15 - 25%	1 - 7%		one-leaved foamflower
	Streptopus roseus		<1%	<1%			rosy twistedstalk
	Athyrium filix-femina			>25%			lady fern
	Viola spp.		<1%	1 - 7%		1 - 7%	violets
	Streptopus amplexifolius			1 - 7%	<1%		clasping twistedstalk
	Veratrum viride			1 - 7%			Indian hellebore
	Dryopteris assimilis		<1%	7 - 15%	<1%		spiny wood fern
	Galium triflorum			1 - 7%	7 - 15%		sweet-scented bedstraw
	Valeriana sitchensis			1 - 7%	7 - 15%		Sitka valerian
	Actaea rubra			<1%	1 - 7%		baneberry
	Equisetum arvense				>25%		common horsetail
	Cinna latifolia				7 - 15%		nodding wood-reed
	Thalictrum occidentale			<1%	1 - 7%		western meadowrue
	Heracleum lanatum			<1%	1 - 7%		cow parsnip
	Calamagrostis canadensis					1 - 7%	bluejoint
	Carex spp.					1 - 7%	sedges
MOSSES	*Brachythecium spp.*	1 - 7%	1 - 7%				brachythecium mosses
	Pleurozium schreberi	15 - 25%	15 - 25%		<1%		red-stemmed feathermoss
	Mnium spp.		<1%	15 - 25%	>25%	1 - 7%	leafy mosses
	Sphagnum spp.					>25%	sphagnums

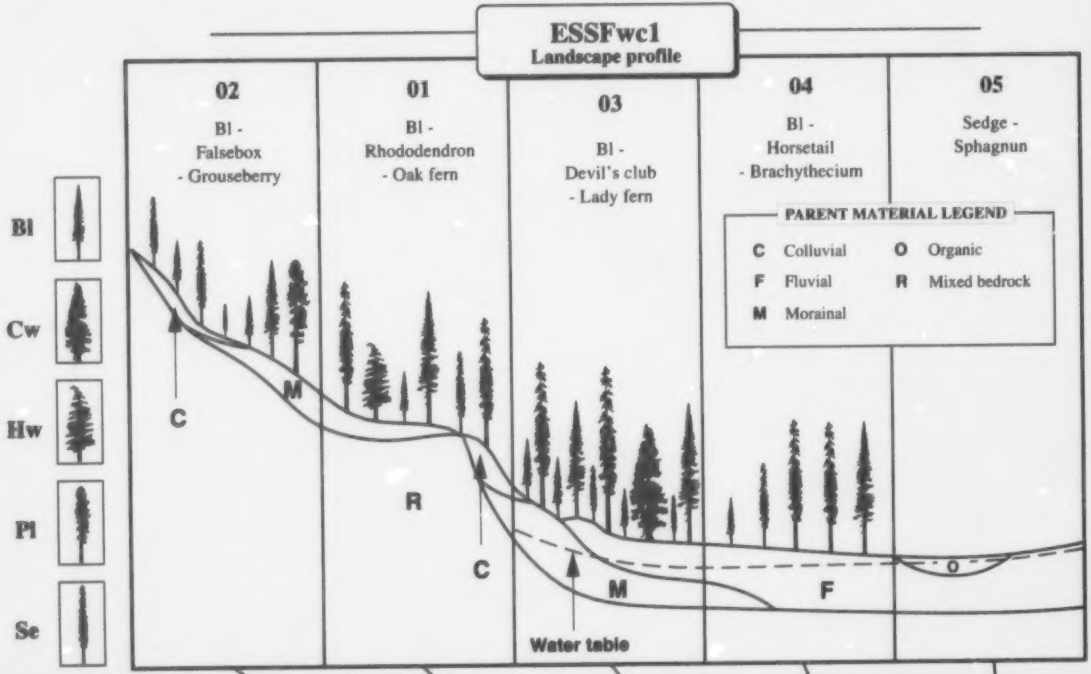
Approximate Cover Classes: <1% 1 - 7% 7 - 15% 15 - 25% >25%

ESSFwc1

Site Series Flowchart


Start
- 6–7 (hg–shd) SMR
- non-forested wetlands and Se bogs
- >5% sedges and/or >5% sphagnums
Y
05
Sedge – Sphagnum
N
- spiny wood fern
- cow-parsnip
- clasping twistedstalk
- western meadowrue
- leafy mosses
N
- 0–4 (vx–m) SMR
- rattlesnake-plantain
- one-sided wintergreen
Y
- 3–4 (sm–m) SMR
- Bl, Se stands
- >5% white-flowered rhododendron
- five-leaved bramble
- oak fern
- rosy twistedstalk
- stiff clubmoss
Y
01
Bl – Rhododendron – Oak fern
N
- 0–3 (vx–sm) SMR
- Se, Bl stands
- falsebox
- poorly developed herb layer
Y
02
Bl – Falsebox – Grouseberry
Y
- 6 (hg) SMR
- Se (Bl) stands
- >5% common horsetail
- mountain sweet-cicely
- nodding wood-reed
Y
04
Bl – Horsetail – Brachythecium
N
- 5–6 (shg–hg) SMR
- Se, Bl stands
- devil's club
- >5% lady fern
- Indian hellebore
- Brewer's mitrewort
Y
03
Bl – Devil's club – Lady fern

Y = Yes; N = No



ESSFwc1
Landscape profile

02
Bl -
Falsebox
- Grouseberry
01
Bl -
Rhododendron
- Oak fern
03
Bl -
Devil's club
- Lady fern
04
Bl -
Horsetail
- Brachythecium
05
Sedge -
Sphagnun
PARENT MATERIAL LEGEND
C Colluvial
F Fluvial
M Morainal
O Organic
R Mixed bedrock
Bl
Cw
Hw
Pl
Se
C
M
R
C
M
F
O
Water table

ESSFwc1 Environmental Table

Site series		02	01	03	04	05
Number of plots		7	6	9	1	6
Soil moisture regime[a] (SMR)		(0)[b]2-3 (vx)sx-sm	3-4(5) sm-m(shg)	5-6 shg-hg	6 hg	6-7 hg-shd
Aspect		variable	variable	variable	n.a.	n.a.
Slope gradient %		15-55	0-35	5-30	flat	0-15
Slope position		upper-mid	variable	mid-lower	toe	depression, toe & level
Parent material		M,C	M(C,F)	F,M	FG	O,F
Soil texture coarse fragments % (min.-**mean**-max.)	0-30 cm	L,$(C,S) 24-**44**-75	L($) 10-**36**-52	$,L(C) 4-**22**-58	C 0	S,$ or organic 0
	30+ cm	C,L(S,$) 40-**60**-80	L(S,$) 30-**59**-83	L,S(C,$) 28-**50**-70	C 2-**2**-2	C,S,L or organic 0-**35**-50
Humus form — LFH thickness cm (min.-**mean**-max.)		Mor (Moder) 0-**4**-13	Mor (Moder) 2-**5**-8	Mor, Moder 1-**6**-16	Mor 12	saturated Mulls, Moders & Mors
Important site features		some shallow, rocky soils	some restricting layers; temporary seepage	seepage 30-100 cm common	presumably on F parent materials	organic veneers over fluvial common; water table 30-100 cm

[a] Environmental features contained in this table are defined in Section 3.4.4.

[b] Values in brackets less common.

ESSFwc1

Management Interpretations[a]

Site series	Number of plots	Common seedling growth limiting factors[a,b]	Relative tree productivity		Vegetation potential - common complexes[c]	Road drainage control needs (see cautions[a,e])	Common site sensitivities (see cautions[a,e])	Other prescription considerations
			Gross volume productivity	Growth class (site index, tree species)				
02	7	Cold soil, Nutrients	Med.	Good (17, Sxw)	Medium - ericaceous shrub, fireweed	High	H forest floor displacement hazard; H surface erosion hazard on all sites; H displacement hazard on steep slopes	Conserve limited organic matter
01	6	Cold soil, Cold air temp., Nutrients, Vegetation	Med.	Good (18, Sxw)	Medium - ericaceous shrub, fireweed, wet alder	High	H forest floor displacement hazard on all sites	Conserve limited organic matter
08	9	Cold soil, Cold air temp., Vegetation, Nutrients (where seepage 31-60cm)	Med.	Good (18, Sxw)	High - ericaceous shrub, wet alder, fern	Very high	H compaction hazard on silty soils; H surface erosion on slopes >15%;	Windthrow hazard; Water table may rise post-harvest; Conserve limited organic matter on moderate and steeper slopes; Random machine travel on silty soils on snowpack

04	1	Cold soil, Cold air temp., Vegetation	Med.	Good (18, Sxw)	High - wet alder, mixed shrub, subalpine herb	Very high	H mass wasting hazard on all sites; VH compaction hazard on clayey soils	Windthrow hazard; Water table may rise post-harvest; Frost prone sites; Random machine travel on snowpack on clayey soils; Special road construction/maintenance; Riparian
05	6	Cold soil, Cold air temp., Wet soil	Non-forested or Very low	Low[f] (4, Sxw)	Low - bog	Very high	H surface erosion hazard on all sites; H compaction hazard on silty soils; H road cut/fill mass wasting on clayey & loamy soils	No timber values; Special road construction/maintenance on clayey and loamy soils; Random machine travel on silty soils on snowpack; Riparian

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[a] **Caution:** Based on sample data plots; some interpretations expected to vary with individual site conditions. Use of original interpretive tools is necessary; these interpretations are presented here to "red flag" common concerns. This table outlines key considerations that should go into management decisions. Rationale and interpretive tools are discussed in Section 3.6.

[b] These include air temperature, soil temperature, vegetation, soil moisture, and soil nutrients; use of SYTEPREP recommended, see Section 3.6.1.

[c] Complexes described in Newton and Comeau (1990).

[d] **Caution:** This is presented here to "red flag" common drainage needs and is not intended to substitute for specific engineering interpretations, see Section 3.6.4.

[e] **Caution:** Site sensitivity keys must be used with your site data for the PHSP; see Section 3.6.5. H = high, 30 - 45% = moderate slope, >45% = steep slope.

[f] Sample size less than five plots for site index determination.

ESSFwc2

Variant Summary

Northern Monashee Wet Cold Engelmann Spruce - Subalpine Fir Variant

Location: North of Nagle Creek in the northern Selkirks and north of the Sullivan River in the Rocky Mountains.

This subzone occurs more extensively in the Kamloops Forest Region. Please refer to A Guide to Site Identification and Interpretation for the Kamloops Forest Region *(Lloyd* et al. *1990) for a detailed description of vegetation, environmental features, and management interpretations.*

Elevation range: 1450 to 1800 m (south aspect); 1400 to 1800 m (north aspect).

Zonal vegetation: Zonal climax sites have stands of Bl and Se. White-flowered rhododendron, black huckleberry, and false azalea are the most common shrubs. Oak fern, Sitka valerian, five-leaved bramble, rosy twistedstalk, and one-leaved foamflower are the dominant herbs. Red-stemmed feathermoss, occurring in patches, is the most common moss.

Distinguishing the ESSFwc2 from adjacent subzones/variants

In the **ICHwk1** most sites have:	- Cw and Hw - no white-flowered rhododendron, false azalea, grouseberry, Indian hellebore, Sitka valerian, or arrow-leaved groundsel - more Douglas maple, paper birch, red-osier dogwood, wild sarsaparilla, and enchanter's nightshade
In the **ICHvk1** most sites have:	- Hw and Cw
zonal sites also have:	- devil's club and lady fern - no white-flowered rhododendron or mountain arnica
In the **ESSFwm** most sites have:	- less white-flowered rhododendron, rosy twistedstalk, and red-stemmed feathermoss
zonal sites also have:	- more false azalea, Utah honeysuckle; falsebox, black gooseberry, oak fern, mountain arnica, western meadowrue, pipecleaner moss, and leafy moss
In the **ESSFvc** most sites have:	- Hm
zonal sites also have:	- spiny wood fern and lady fern

ESSFwc4

Variant Summary

Selkirk Wet Cold Engelmann Spruce - Subalpine Fir Variant

Location: Upper slopes in the Monashee and Selkirk mountains south of Revelstoke.

Elevation range: 1650 to 1950 m (south aspect); 1600 to 1950 m (north aspect).

Climate: Moist Climatic Region; no climate data. The ESSFwc4 is likely colder and wetter, with more snow than the ICH and the ESSFwc1; drier, with less snow than the ESSFvc1; and wetter, with more snow than the ESSFdc1.

Soils, geology, and landforms: Common rock types in the Selkirk Mountain areas of the ESSFwc4 include granodiorite, quartz diorite, shale, argillite, quartzite, and slate. In the Monashee Mountain area of this variant, bedrock types consist of gneiss, schist, granite, granodiorite, quartz diorite, basalt, and andesite. Morainal soils with loamy to silty surface textures occur on lower to upper slopes. Colluvial soils with silty textures are found on upper, steeper slopes. These shallow to bedrock soils are more frequent in this variant than in the ESSFwc1. Fluvial soils with silty or loamy surface textures occur on lower to level slopes. Depressional sites often have organic soils. Glaciofluvial soils with variable textures are found on toe and lower slope positions. Seepage is common on mid to lower slopes.

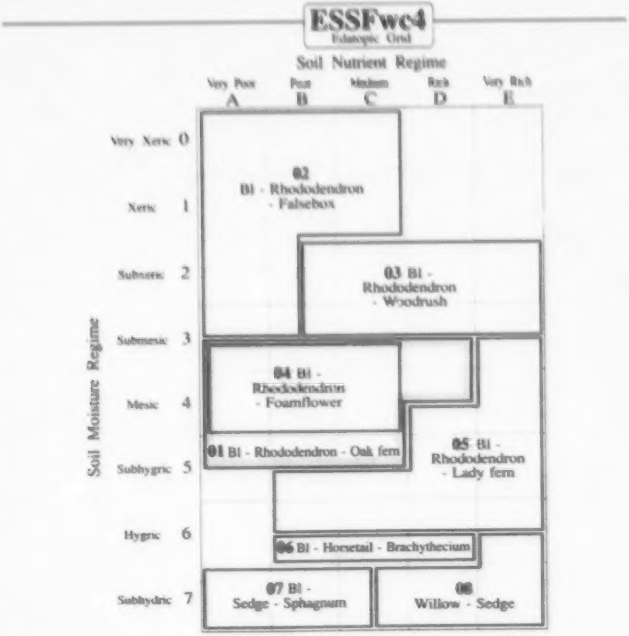
Zonal vegetation: Climax zonal sites have stands of Bl and Se. White-flowered rhododendron, black huckleberry, and gooseberry are common shrubs. Herbs include oak fern, one-leaved foamflower, Sitka valerian, and five-leaved bramble.

Distinguishing the ESSFwc4 from adjacent subzones/variants

In the **ESSFwc1** most sites have:	- more Hw, Cw, thimbleberry, false Solomon's-seal, bunchberry, and sweet-scented bedstraw - less white-flowered rhododendron, small-flowered woodrush, and mountain hairgrass
wet sites have:	- devil's club and cow-parsnip
In the **ESSFvc** most sites have:	- Hm - more false Solomon's-seal and rosy twistedstalk
dry sites have:	- partridgefoot - no Pl or grouseberry
In the **ESSFwm** most sites have:	- Lw and Pw - no small-flowered woodrush or juniper haircap moss - more false azalea - less mountain hairgrass, Sitka valerian, and Indian hellebore
wet sites have:	- bluejoint - less five-stamened mitrewort, arrow-leaved groundsel, and globeflower
In the **ESSFdc1** most sites have:	- trapper's tea - no spiny wood fern, lady fern, small twistedstalk, or oval-leaved blueberry - more Pl, grouseberry, and arctic lupine - less black gooseberry and small-flowered woodrush
dry sites have:	- more common juniper and pinegrass

Forest characteristics: Relatively long fire return periods have led to few stands with seral species. Stand replacement often occurs through insects, disease, and windthrow. The transition to the parkland, starting at about 1900 m, is critical since regeneration becomes very difficult and tree growth is very slow. The presence of mountain-heathers and tree islands indicate the parkland. In the extreme southern Selkirks, south of Nelson, bear-grass may dominate the understory vegetation. This is indicative of a drier, warmer climate. However, due to the lack of sufficient sampling in this area, a separate unit has not been identified.

Wildlife habitat: Extensive old-growth forests support a range of dependent wildlife species. Maintenance of enough old growth to preserve these species is important. Maintenance of insect-feeding birds through preservation of snags and large woody debris will reduce the incidence of insect pest outbreaks.


ESSFwc4
Edatopic Grid
Soil Nutrient Regime
Very Poor A
Poor B
Medium C
Rich D
Very Rich E
Soil Moisture Regime
Very Xeric 0
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02 Bl - Rhododendron - Falsebox
03 Bl - Rhododendron - Woodrush
04 Bl - Rhododendron - Foamflower
01 Bl - Rhododendron - Oak fern
05 Bl - Rhododendron - Lady fern
06 Bl - Horsetail - Brachythecium
07 Bl - Sedge - Sphagnum
08 Willow - Sedge

Shading used where considerable site series overlap occurs.

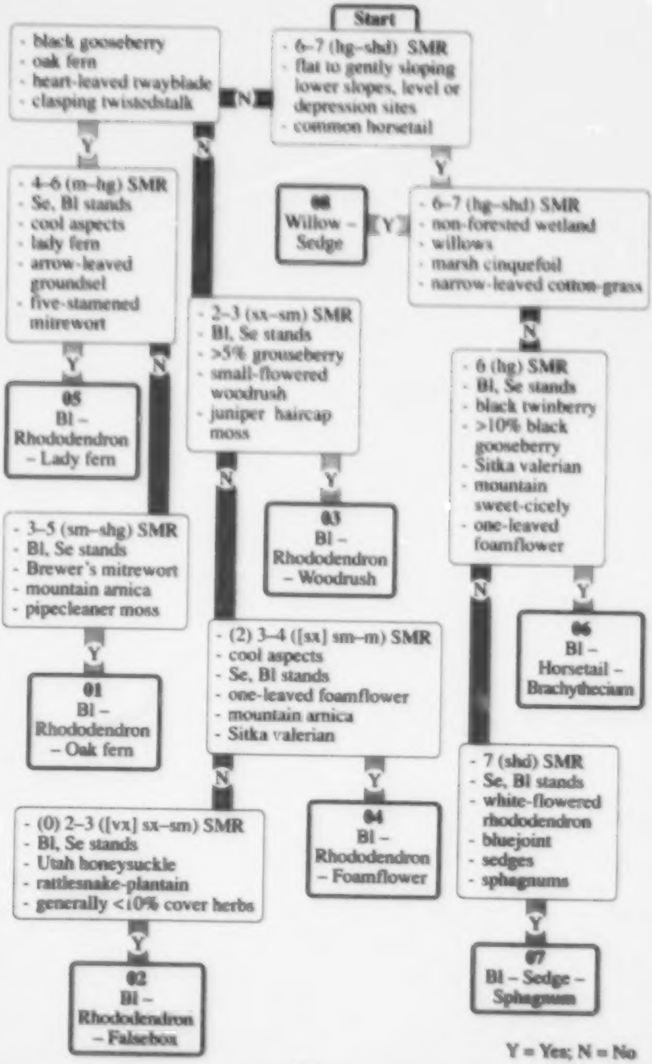
ESSFwc4 Vegetation Table

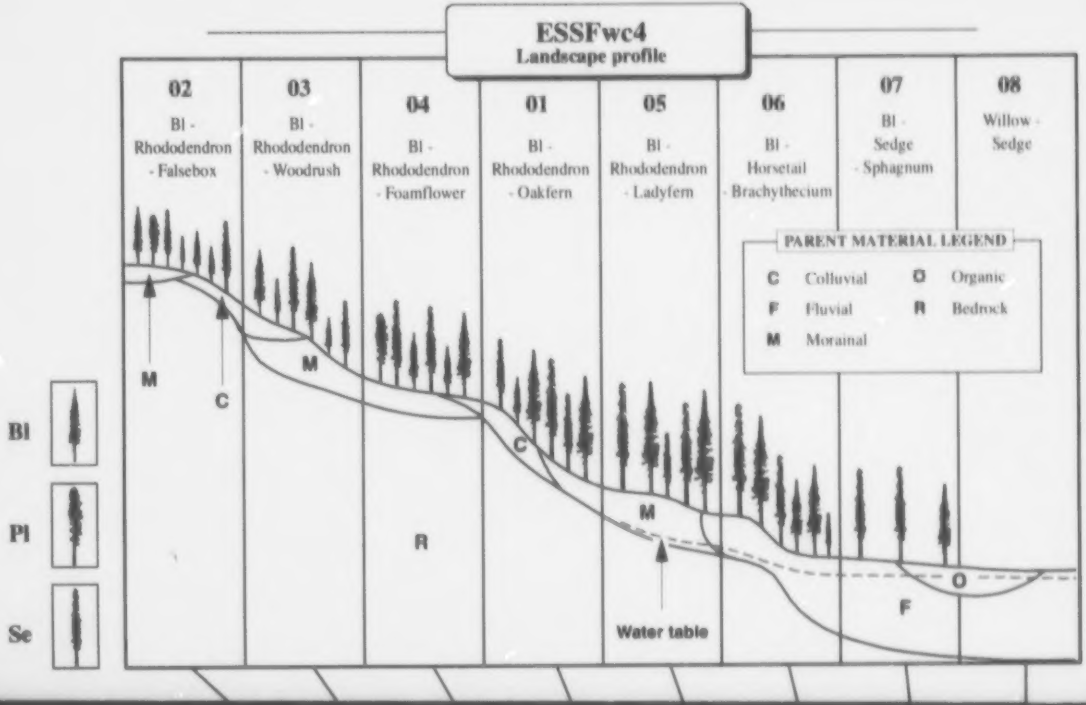
	Site Series	02	03	04	01	05	06	07	08	
TREES	*Pinus contorta*	<1%		1 - 7%						lodgepole pine
	Picea engelmannii	15 - 25%	15 - 25%	15 - 25%	15 - 25%	>25%	15 - 25%	15 - 25%		Engelmann spruce
	Abies lasiocarpa	>25%	>25%	15 - 25%	>25%	>25%	>25%	7 - 15%		subalpine fir
SHRUBS	*Paxistima myrsinites*	1 - 7%		1 - 7%	<1%					falsebox
	Vaccinium membranaceum	15 - 25%	15 - 25%	15 - 25%	15 - 25%	>25%	1 - 7%	1 - 7%		black huckleberry
	Rhododendron albiflorum	15 - 25%	15 - 25%	>25%	>25%	15 - 25%		1 - 7%		white-flowered rhododendron
	Lonicera utahensis	1 - 7%	<1%	1 - 7%	1 - 7%	<1%				Utah honeysuckle
	Sorbus sitchensis			1 - 7%						Sitka mountain-ash
	Ribes lacustre				1 - 7%	7 - 15%	15 - 25%			black gooseberry
	Vaccinium ovalifolium				<1%		1 - 7%	<1%		oval-leaved blueberry
	Salix spp.								15 - 25%	willows
HERBS	*Orthilia secunda*	1 - 7%		1 - 7%	1 - 7%	<1%				one-sided wintergreen
	Vaccinium scoparium		7 - 15%				<1%			grouseberry
	Luzula parviflora		15 - 25%		<1%					small-flowered woodrush
	Arnica latifolia		1 - 7%	15 - 25%	1 - 7%					mountain arnica
	Rubus pedatus	<1%	1 - 7%	1 - 7%	7 - 15%	1 - 7%				five-leaved bramble
	Mitella breweri		<1%	<1%	1 - 7%	<1%				Brewer's mitrewort
	Tiarella trifoliata var. unifoliata			1 - 7%	15 - 25%	1 - 7%	7 - 15%			one-leaved foamflower
	Valeriana sitchensis			1 - 7%	7 - 15%	1 - 7%	15 - 25%			Sitka valerian
	Streptopus amplexifolius				<1%	1 - 7%	<1%	<1%		clasping twistedstalk
	Gymnocarpium dryopteris				15 - 25%	>25%	1 - 7%			oak fern
	Veratrum viride				<1%	1 - 7%	<1%			Indian hellebore
	Thalictrum occidentale				1 - 7%		<1%			western meadowrue
	Athyrium filix-femina					15 - 25%				lady fern
	Senecio triangularis				<1%	1 - 7%	1 - 7%	<1%	<1%	arrow-leaved groundsel
	Lycopodium annotinum						1 - 7%			stiff clubmoss
	Osmorhiza chilensis						1 - 7%			mountain sweet-cicely
	Equisetum arvense						15 - 25%	1 - 7%	1 - 7%	common horsetail
	Calamagrostis canadensis							>25%	1 - 7%	bluejoint
	Carex spp.							1 - 7%	1 - 7%	sedges
MOSSES, LICHENS AND LIVERWORTS	*Cladonia spp.*	<1%	1 - 7%	<1%						cladonias
	Rhytidiopsis robusta	1 - 7%	1 - 7%	1 - 7%	1 - 7%					pipecleaner moss
	Polytrichum juniperinum		15 - 25%	<1%						juniper haircap moss
	Barbilophozia lycopodioides	7 - 15%	<1%	15 - 25%	1 - 7%					common leafy liverwort
	Mnium spp.			1 - 7%	7 - 15%	>25%	15 - 25%	1 - 7%	<1%	leafy mosses
	Sphagnum spp.							>25%	15 - 25%	sphagnums

Approximate Cover Classes: ▫ <1% ▭ 1 - 7% ▭ 7 - 15% ▭ 15 - 25% ▭ >25%

ESSFwc4

Site Series Flowchart


Start
- 6–7 (hg–shd) SMR
- flat to gently sloping lower slopes, level or depression sites
- common horsetail
N
- black gooseberry
- oak fern
- heart-leaved twayblade
- clasping twistedstalk
Y
- 4–6 (m–hg) SMR
- Se, Bl stands
- cool aspects
- lady fern
- arrow-leaved groundsel
- five-stamened mitrewort
Y
05 Bl – Rhododendron – Lady fern
N
- 3–5 (sm–shg) SMR
- Bl, Se stands
- Brewer's mitrewort
- mountain arnica
- pipecleaner moss
Y
01 Bl – Rhododendron – Oak fern
N
- 2–3 (sx–sm) SMR
- Bl, Se stands
- >5% grouseberry
- small-flowered woodrush
- juniper haircap moss
Y
03 Bl – Rhododendron – Woodrush
N
- (2) 3–4 ([sx] sm–m) SMR
- cool aspects
- Se, Bl stands
- one-leaved foamflower
- mountain arnica
- Sitka valerian
Y
04 Bl – Rhododendron – Foamflower
N
- (0) 2–3 ([vx] sx–sm) SMR
- Bl, Se stands
- Utah honeysuckle
- rattlesnake-plantain
- generally <10% cover herbs
Y
02 Bl – Rhododendron – Falsebox
Y
- 6–7 (hg–shd) SMR
- non-forested wetland
- willows
- marsh cinquefoil
- narrow-leaved cotton-grass
Y
00 Willow – Sedge
N
- 6 (hg) SMR
- Bl, Se stands
- black twinberry
- >10% black gooseberry
- Sitka valerian
- mountain sweet-cicely
- one-leaved foamflower
Y
06 Bl – Horsetail – Brachythecium
N
- 7 (shd) SMR
- Se, Bl stands
- white-flowered rhododendron
- bluejoint
- sedges
- sphagnums
Y
07 Bl – Sedge – Sphagnum
Y = Yes; N = No


ESSFwc4
Landscape profile
02
Bl - Rhododendron - Falsebox
03
Bl - Rhododendron - Woodrush
04
Bl - Rhododendron - Foamflower
01
Bl - Rhododendron - Oakfern
05
Bl - Rhododendron - Ladyfern
06
Bl - Horsetail - Brachythecium
07
Bl - Sedge - Sphagnum
08
Willow - Sedge
PARENT MATERIAL LEGEND
C Colluvial
F Fluvial
M Morainal
O Organic
R Bedrock
M
C
M
R
C
M
Water table
O
F
Bl
Pl
Se

ESSFwc4 Environmental Table

Site series		02	03	04	01	05	06	07	08
Number of plots		10	4	5	28	5	1	2	4
Soil moisture regime[a] (SMR)		(0)[b]2-3 (vx)sx-sm	2-3 sx-sm	(2)3-4 (sx)sm-m	(2)3-5 (sx)sm-shg	4-6 m-hg	6 hg	7 shd	6-7 hg-shd
Aspect		variable	variable	cool	variable	cool	variable	n.a	n.a.
Slope gradient %		variable	0-40	25-70	variable	10-25	0-20	0	0
Slope position		upper-mid (crest)	mid-upper	mid (lower)	variable	variable	lower-level	lower-level	level, depression
Parent material		C,M	M(C)	C,M	M,C,F	M(C,F)	F	O,F	O,M,F
Soil texture coarse fragments % (min.-**mean**-max.)	0-30 cm	L,C($) 30-**50**-70	L,$ 43-**47**-50	L,$ 30-**36**-40	L($,C) 14-**32**-55	$,L 30-**41**-53	C 15-**15**-15	S,$ 0	$,L 0-**10**-20
	30+ cm	L,S($) 45-**67**-90	L(S,$) 63-**67**-70	L(S,C) 40-**55**-67	L,S($,C) 23-**49**-80	L 47-**49**-55	L 30-**30**-30	S,$ 0	L($) 15-**27**-27
Humus form — LFH thickness cm (min.-**mean**-max.)		Mor 2-**6**-13	Moder, Mor 1-**2**-3	Mor 1-**3**-6	Mor (Moder) 2-7-30	Mor 2-**5**-10	Mor 4	saturated Mors 17-**48**-80	saturated Mors 4-**13**-26
Important site features		generally, steeply sloping; restricting layers common; very low cover of herbs	—	—	some sites with temporary seepage <100 cm	some sites with seepage <100 cm; if not on a cool aspect, then affected by cold air	—	water table near surface (<30 cm); organic veneers	poorly drained open sites; some organic veneers

[a] Environmental features contained in this table are defined in Section 3.4.4.

[b] Values in brackets less common.

ESSFwc4

Management Interpretations[a]

Site series	**Number of plots**	**Common seedling growth limiting factors**[a,b]	**Relative tree productivity**		**Vegetation potential - common complexes**[c]	**Road drainage control needs (see cautions**[d,e]**)**	**Common site sensitivities (see cautions**[d,e]**)**	**Other prescription considerations**[f]
			Gross volume productivity	**Growth class (site index, tree species)**				
02	10	Cold air temp., Dry soils, Nutrients (on clay soils)	Low	Medium (15, Se)	Low - ericaceous shrub, fireweed	High	H compaction hazard on clayey soils; H surface erosion and forest floor displacement hazard on moderate slopes; H displacement hazard on very steep slopes.	Random machine travel on snow pack on clayey soils; Conserve limited organic matter on moderate slopes; Special road construction/maintenance on very steep slopes
08	4	Cold air temp., Cold soil, Nutrients	Med.	Good (16, Se)	Low - ericaceous shrub, fireweed	High	H forest floor displacement and surface erosion hazard on moderate and steeper slopes	Special road construction/maintenance on very steep slopes
04	5	Cold soil, Cold air temp., Vegetation, Nutrients (on slopes >30cm)	Med.	Good (18, Se)	Medium - ericaceous shrub, fireweed	High	H compaction hazard on silty soils; H surface erosion & forest floor displacement hazard; H displacement hazard on steep slopes; H mass wasting hazard on very steep slopes	Random machine travel on snowpack on clayey soils; Conserve limited organic matter; Special road construction/maintenance on very steep slopes
01	28	Cold soil, Cold air temp., Vegetation, Nutrients (where C.F.30-70% on slope >30% or C.F.<30% on slope >60%)	Med.	Good (18, Se)	Medium - ericaceous shrub, fireweed	Very high	H surface erosion & forest floor displacement hazard on moderate slopes; H mass wasting hazard on steep slopes	Conserve limited organic matter on moderate and steep slopes; Special road construction/maintenance on very steep slopes

05	5	Cold soil, Vegetation, Cold air temp., Nutrients (on coarser soils)	Med.	Good (18, Se)	Medium - ericaceous shrub, fireweed, subalpine herb	Very high	-	-
06	1	Cold soil, Cold air temp., Vegetation, Nutrients	Med.	Good (18, Se)	High - fireweed, subalpine herb, mixed shrub	Very high	H mass wasting and forest floor displacement hazard on all sites; H compaction hazard on clayey soils	Windthrow hazard; Water table may rise post-harvest; Frost prone sites; Conserve organic matter; Special road construction/maintenance; Random machine travel on snowpack on clayey soils; Riparian
07	2	Cold soil, Wet soil, Cold air temp., Vegetation	Very low	Low[g] (4, Se)	High - reedgrass	Very high	H surface erosion and mass wasting hazard on all sites; H compaction and displacement hazard on organics	No timber values; Random machine travel on snowpack on organics; Special road construction/maintenance; Riparian
08	4	Cold soil, Wet soil, Cold air temp.	n.a.	n.a.	Medium - bog	Very high	H compaction and displacement hazard on organics	No timber values; Riparian

---

[a] **Caution**: Based on sample data; some interpretations expected to vary with individual site conditions. Use of original interpretive tools is necessary; these interpretations are presented here to "red flag" common concerns. This table outlines key considerations that should go into management decisions. Rationale and interpretive tools are discussed in Section 3.6.

[b] These include air temperature, soil temperature, vegetation, soil moisture, and soil nutrients; use of SYTEPREP recommended, see Section 3.6.1. C.F. = coarse fragments.

[c] Complexes described in Newton and Comeau (1990).

[d] **Caution**: This is presented here to "red flag" common drainage needs and is not intended to substitute for site specific engineering interpretations, see Section 3.6.4.

[e] **Caution**: Site sensitivity keys must be used with your site data for the PHSP; see Section 3.6.5. H = high, 30 - 45% = moderate slope, 45 - 60% = steep slope, >60% = very steep slope.

[f] Partial cutting or no harvesting recommended where regeneration restricted to tree islands (above approximately 1 900 m).

[g] Sample size less than five plots for site index determination.

ESSFwm

Subzone Summary

Wet Mild Engelmann Spruce - Subalpine Fir Subzone

Location: Upper slopes in the western Purcell Mountains and in the Rocky Mountains from the Cummins River to the Beaverfoot River, and adjacent to the Lower Elk River.

Elevation range: 1600 to 1950 m (south aspect); 1500 to 1950 m (north aspect).

Climate: Moist Climatic Region; no climate data. The ESSFwm is likely warmer and more continental than the ESSFwc2; wetter than the ESSFdk; and colder and wetter than the ICHmw1.

Soils, geology, and landforms: Common rock types in the ESSFwm include limestone, shale, siltstone, sandstone, conglomerate, argillite, quartzite, and granodiorite. Colluvial soils with loamy or silty textures are located on the steeper areas of middle to upper slopes. Glaciofluvial soils with loamy or silty surface textures occur on mid to lower slopes. Fluvial soils with loamy or silty surface textures are located on lower and level slope positions. Some morainal soils with silty or loamy surface textures occur on lower to middle slopes. Calcareous subsoils frequently occur in this subzone.

Zonal vegetation: Zonal sites have stands of Bl and Se. The shrub understory consists of false azalea, black huckleberry, white-flowered rhododendron, and Utah honeysuckle. Oak fern, mountain arnica, and one-leaved foamflower are common herbs.

Distinguishing the ESSFwm from adjacent subzones/variants

In the **ESSFdk** most sites have:	- grouseberry, heart-leaved arnica, and low bilberry
zonal sites also have:	- no violet or mountain sweet-cicely
dry sites have:	- red-stemmed feathermoss
wet sites have:	- oak fern and leafy moss - less one-leaved foamflower.
In the **ESSFwc1** most sites have:	- no false azalea
zonal sites also have:	- white-flowered rhododendron, five-leaved bramble, rosy twistedstalk, and red-stemmed feathermoss - no mountain arnica or mountain sweet-cicely
wet sites have:	- devil's club, Sitka valerian, and spiny wood fern
In the **ESSFwc2** most sites have:	- more white-flowered rhododendron, rosy twistedstalk, and red-stemmed feathermoss
zonal sites also have:	- less false azalea, Utah honeysuckle, falsebox, black gooseberry, oak fern, mountain arnica, western meadowrue, pipecleaner moss, and leafy moss
In the **ESSFwc4** most sites have:	- no false azalea
zonal sites also have:	- five-leaved bramble, Indian hellebore, and Brewer's mitrewort
wet sites have:	- white-flowered rhododendron, Sitka valerian, arrow-leaved groundsel, and spiny wood fern - no black twinberry or queen's cup
In the **ICHmw2** most sites have:	- Cw, Pw, Lw, Fd, and Hw - no false azalea

dry sites have: - prince's pine and red-stemmed feathermoss

Forest Characteristics: Fire is an important disturbance. A mix of seral and old-growth stands is found.

The area north of Golden is transitional to the ESSFwc2. Identification tools for both units should be consulted for classification.

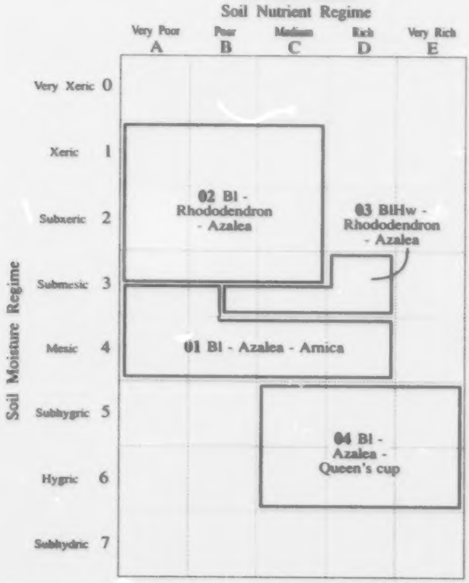
The lower transition to the ICH is often a very brushy area with Sitka alder.

It is important to note the upper transition to the parkland (above 1900 m). This transition is indicated by the presence of mountain-heathers and tree islands. Tree growth and regeneration become very difficult.

Wildlife habitat: The extensive fire history has maintained a predominance of early seral species. This subzone is important summer range for deer, elk, moose, and bighorn sheep. Remaining pockets of old growth are key to the maintenance of insect-feeding cavity nesting birds which aid in control of forest insect pests.

ESSFwm

Edatopic Grid


Soil Nutrient Regime
Very Poor
A
Poor
B
Medium
C
Rich
D
Very Rich
E
Soil Moisture Regime
Very Xeric 0
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02 Bl - Rhododendron - Azalea
03 BlHw - Rhododendron - Azalea
01 Bl - Azalea - Arnica
04 Bl - Azalea - Queen's cup

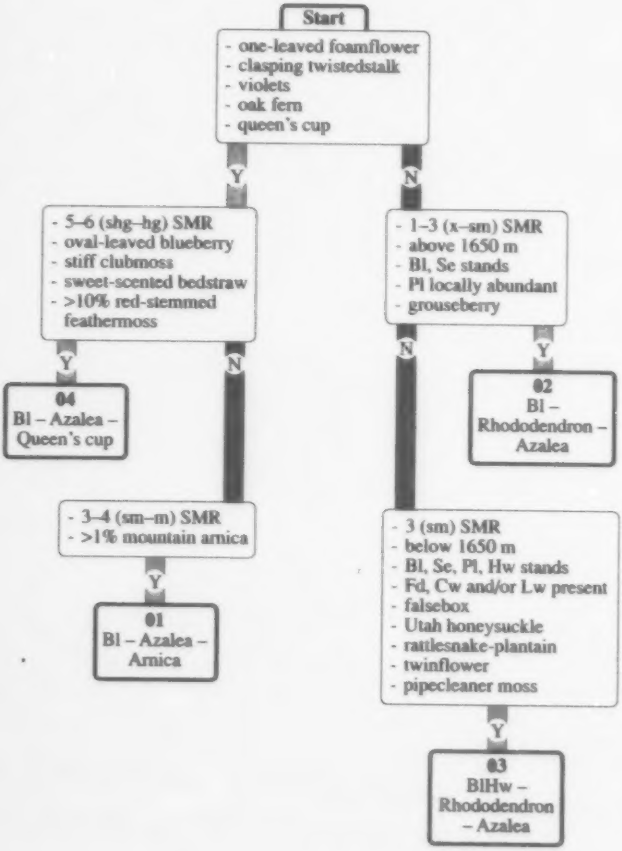
ESSFwm Vegetation Table

	Site Series	02	03	01	04	
TREES	*Pinus monticola*	<1%	1 - 7%			western white pine
	Larix occidentalis		<1%			western larch
	Pinus contorta	1 - 7%	15 - 25%		<1%	lodgepole pine
	Abies lasiocarpa	15 - 25%	>25%	>25%	>25%	subalpine fir
	Picea engelmannii	7 - 15%	15 - 25%	>25%	>25%	Engelmann spruce
	Tsuga heterophylla	<1%	7 - 15%		<1%	western hemlock
SHRUBS	*Alnus crispa ssp. sinuata*	<1%	1 - 7%		7 - 15%	Sitka alder
	Rhododendron albiflorum	>25%	15 - 25%	7 - 15%	1 - 7%	white-flowered rhododendron
	Vaccinium membranaceum	15 - 25%	15 - 25%	15 - 25%	7 - 15%	black huckleberry
	Menziesia ferruginea	7 - 15%	15 - 25%	15 - 25%	15 - 25%	false azalea
	Paxistima myrsinites		1 - 7%	<1%	1 - 7%	falsebox
	Lonicera utahensis	<1%	<1%	7 - 15%	<1%	Utah honeysuckle
	Ribes lacustre			1 - 7%	1 - 7%	black gooseberry
	Vaccinium ovalifolium				<1%	oval-leaved blueberry
	Rubus parviflorus				1 - 7%	thimbleberry
HERBS	*Vaccinium scoparium*	1 - 7%			<1%	grouseberry
	Linnaea borealis		1 - 7%			twinflower
	Orthilia secunda		1 - 7%	<1%	<1%	one-sided wintergreen
	Goodyera oblongifolia		<1%			rattlesnake-plantain
	Tiarella trifoliata var. unifoliata		<1%	7 - 15%	7 - 15%	one-leaved foamflower
	Thalictrum occidentale			1 - 7%		western meadowrue
	Clintonia uniflora			1 - 7%	7 - 15%	queen's cup
	Viola spp.			<1%	1 - 7%	violets
	Gymnocarpium dryopteris			15 - 25%	15 - 25%	oak fern
	Arnica latifolia			7 - 15%	1 - 7%	mountain arnica
	Rubus pedatus			<1%	7 - 15%	five-leaved bramble
	Lycopodium annotinum				<1%	stiff clubmoss
	Mitella breweri				<1%	Brewer's mitrewort
	Athyrium filix-femina				<1%	lady fern
MOSSES, LICHENS AND LIVERWORTS	*Peltigera spp.*	<1%	<1%		<1%	peltigeras
	Rhytidiopsis robusta	7 - 15%	1 - 7%	7 - 15%	7 - 15%	pipecleaner moss
	Barbilophozia lycopodioides	<1%	<1%	<1%	1 - 7%	common leafy liverwort
	Pleurozium schreberi		<1%		15 - 25%	red-stemmed feathermoss
	Mnium spp.			1 - 7%	1 - 7%	leafy mosses

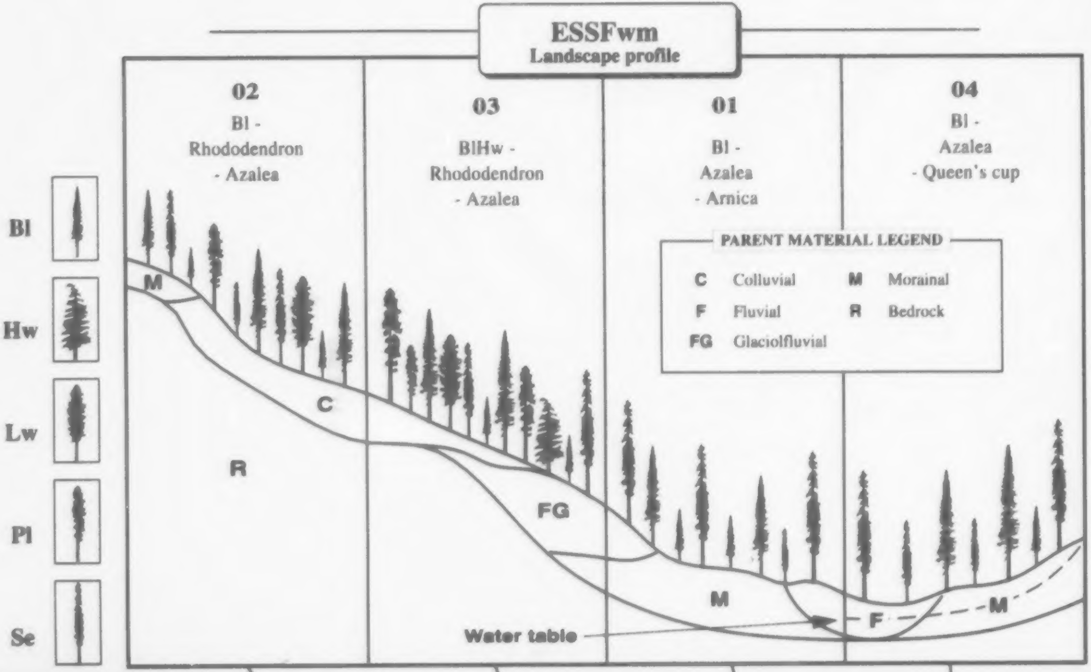
Approximate Cover Classes: ▭ <1% ▭ 1 - 7% ▭ 7 - 15% ▭ 15 - 25% ▭ >25%

ESSFwm

Site Series Flowchart


Start
- one-leaved foamflower
- clasping twistedstalk
- violets
- oak fern
- queen's cup
Y
N
- 5–6 (shg–hg) SMR
- oval-leaved blueberry
- stiff clubmoss
- sweet-scented bedstraw
- >10% red-stemmed feathermoss
Y
N
04
Bl – Azalea – Queen's cup
- 3–4 (sm–m) SMR
- >1% mountain arnica
Y
01
Bl – Azalea – Arnica
- 1–3 (x–sm) SMR
- above 1650 m
- Bl, Se stands
- Pl locally abundant
- grouseberry
N
Y
02
Bl – Rhododendron – Azalea
- 3 (sm) SMR
- below 1650 m
- Bl, Se, Pl, Hw stands
- Fd, Cw and/or Lw present
- falsebox
- Utah honeysuckle
- rattlesnake-plantain
- twinflower
- pipecleaner moss
Y
03
BlHw – Rhododendron – Azalea

Y = Yes; N = No



ESSFwm
Landscape profile

Bl
Hw
Lw
Pl
Se
02
Bl - Rhododendron - Azalea
03
BlHw - Rhododendron - Azalea
01
Bl - Azalea - Arnica
04
Bl - Azalea - Queen's cup
PARENT MATERIAL LEGEND
C Colluvial
F Fluvial
FG Glaciolfluvial
M Morainal
R Bedrock
M
C
R
FG
M
F
M
Water table

ESSFwm Environmental Table

Site series		02	03	01	04
Number of plots		5	3	5	9
Soil moisture regime[a] (SMR)		1-3 x-sm	3 sm	3-4 sm-m	5-6 shg-hg
Aspect		variable	variable	variable	variable
Slope gradient %		20-55	5-45	10-50	0-35
Slope position		upper-lower	upper-lower	mid-lower	mid-lower
Parent material		C,M	C,FG	C,FG,M,F	F,M,C
Soil texture coarse fragments % (min.-**mean**-max.)	0-30 cm	L($)[b] 38-**45**-55	L 15-**30**-50	$(L) 18-**23**-24	L($,C,S) 26-**35**-45
	30+ cm	L(S) 67-**68**-75	L(S) 25-**56**-75	$,L(S) 25-**46**-60	L(S,$) 50-**60**-77
Humus form — LFH thickness cm (min.-**mean**-max.)		Moder (Mor) 1-**4**-5	Mor, Moder 2-**5**-10	Mor 3-**4**-6	Moder (Mor) 3-**4**-11
Important site features		above 1650 m; root-restricting layers	below 1650 m	—	nutrient rich soils

---

[a] Environmental features contained in this table are defined in Section 3.4.4.

[b] Values in brackets less common.

ESSFwm

Management Interpretations[a]

Site series	Number of plots	Common seedling growth limiting factors[a,b]	Relative tree productivity		Vegetation potential -common complexes[c]	Road drainage control needs (see cautions[a,c])	Common site sensitivities (see cautions[a-e])	Other prescription considerations[f]
			Gross volume productivity	Growth class (site index, tree species)				
02	5	Cold soil, Dry soil, Vegetation, Nutrients	Low	Medium[g] (15, Se)	Low - fireweed, ericaceous shrub	High	H forest floor displacement hazard on all sites; H displacement hazard on steep slopes; H surface erosion hazard on moderate slopes	Conserve limited organic matter
03	3	Cold soil, Vegetation	Med.	Good[g] (18, Se)	Medium - mixed shrub, dry alder, fireweed	High	H surface erosion and forest floor displacement hazard on moderate slopes	Conserve limited organic matter on moderate and steeper slopes

01	5	Cold soil, Cold air temp., Nutrients (where slope >30%)	Med.	Good[g] (18, Se)	Medium - fireweed, ericaceous shrub	High	H compaction hazard on silty soils; H surface erosion and forest floor displacement hazard on moderate slopes; H mass wasting hazard on steep slopes	Conserve limited organic matter on moderate and steeper slopes; Flat sites frost prone; Special road construction/maintenance on steep slopes; Random machine travel on silty soils on snowpack
04	9	Cold soil, Cold air temp.	Med.	Good (18, Se)	Medium - mixed shrub, fireweed	Very high	H surface erosion and forest floor displacement hazard on all sites; H mass wasting hazard on moderate slopes	Windthrow hazard; Water table may rise post-harvest; Frost prone sites; Conserve organic matter; Special road construction/maintenance on moderate to steeper slopes; Riparian

---

[a] **Caution**: Based on sample plot data; some interpretations expected to vary with individual site conditions. Use of original interpretive tools is necessary; these interpretations are presented here to "red flag" common concerns. This table outlines key considerations that should go into management decisions. Rationale and interpretive tools are discussed in Section 3.6.

[b] These include air temperature, soil temperature, vegetation, soil moisture, and soil nutrients; use of SYTEPREP recommended, see Section 3.6.1.

[c] Complexes described in Newton and Comeau (1990).

[d] **Caution**: This is presented here to "red flag" common drainage needs and is not intended to substitute for site specific engineering interpretations, see Section 3.6.4.

[e] **Caution**: Site sensitivity keys must be used with your site data for the PHSP; see Section 3.6.5. H = high, 30 - 45% = moderate slope, >45% = steep slope.

[f] Partial cutting or no harvesting recommended where regeneration restricted to tree islands (above approximately 1 900 m).

[g] Sample size less than five plots for site index determination.

5.3 Wet Climatic Region

ICHwk1

Variant Summary

Wells Gray Wet Cool Interior Cedar - Hemlock Variant

Location: Within the Nelson Forest Region, the ICHwk1 is found from valley bottoms to mid slopes in the upper Duncan, Incomapleux, Akolkolex, Illecillewaet, and Gold rivers and upper Pingston Creek, along the Revelstoke Reservoir north to the Goldstream River and the Mica Reservoir, north of Smith Creek. This variant also occurs extensively in the Kamloops and Prince George Forest Regions.

Elevation range: 400 to 1400 m (south aspect); 400 to 1350 (north aspect).

Climate[30]**:** Wet Climatic Region; warm, wet summers; cool winters with moderate snowfall. Soils generally do not dry out in late summer except for a short period on dry sites. Snowpacks are moderate to deep and of moderate duration, preventing soils from freezing to any significant depth, often even when the soil is bladed, due to frequent snowfalls. Major climatic limitations to growth are limited to frost in depressional areas.

Soils, geology, and landforms: Common rock types in the Purcell Mountain area of the ICHwk1 include slate, argillite, quartzite, limestone, sandstone, and conglomerate. The Selkirk Mountain areas of this variant are underlain by granitics, argillite, slate, quartzite, schist, sandstone, and conglomerate. In the Monashee Mountain area of this variant, bedrock consists of gneiss, schist, shale, argillite, limestone, and granitics. Morainal soils with loamy or silty surface textures occur on all slope positions. Glaciofluvial soils with sandy or silty textures are found in proximity to morainal soils. Fluvial soils with variable textures occur on lower or level slopes. Colluvial soils with silty or loamy textures occur on mid slope to crest positions. Shallow bedrock is a significant root restricting layer in these soils.

Zonal vegetation: Climax zonal sites have Hw and Cw stands. Sxw is the most common seral species. Small amounts of falsebox and oval-leaved blueberry are commonly found. Oak fern, one-leaved foamflower and queen's cup are common herbs. The moss layer is well developed and includes red-stemmed feathermoss, pipecleaner moss, and step moss.

Distinguishing the ICHwk1 from adjacent subzones/variants

In the **ICHvk1** most sites have:	- more twinflower
zonal sites also have:	- lady fern and >10% devil's club - no falsebox or Utah honeysuckle
dry sites have:	- spiny wood fern
In the **ICHmw1** most sites have:	- more Pl, Pw, and Fd - less spiny wood fern
zonal sites also have:	- no devil's club - less oak fern
dry sites have:	- common juniper, soopolallie and kinnikinnick
In the **ICHmw2** most sites have:	- more Lw, Pl, Pw, and Fd
zonal sites also have:	- no devil's club - less oak fern
dry sites have:	- tall Oregon-grape, baldhip rose, common juniper, round-leaved alumroot, pinegrass, and juniper haircap moss
In the **ICHmw3** most sites have:	- more Pl, Pw, and Fd
zonal sites also have:	- less oak fern

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[30] Values for climate descriptors given in Appendix 12.

In the ESSFwm, ESSFwc1, ESSFwc2, ESSFvc

most sites have:
- white-flowered rhododendron, false azalea, grouseberry, arrow-leaved groundsel, Indian hellebore, and Sitka valerian
- no Douglas maple or wild sarsaparilla
- more Bl and Se (ESSFvc has Hm)
- less Cw and Hw

wet sites have:
- no red-osier dogwood or enchanter's nightshade

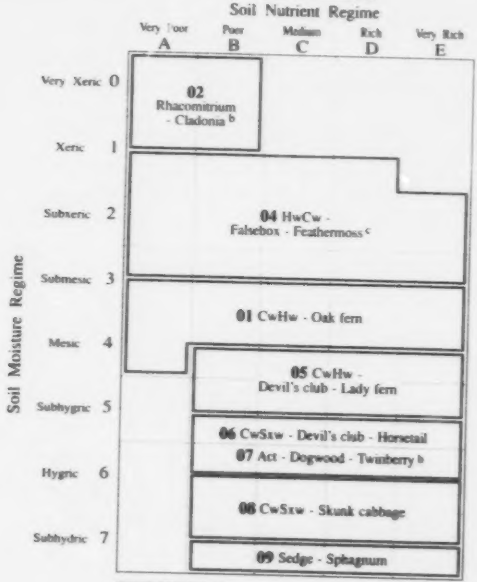
Forest characteristics: The rarity of wildfire has led to the occurrence of numerous old-growth Cw and Hw stands. Prolific growth of the mixed shrub or fern vegetation complexes may occur on zonal and wetter sites after harvest.

Wildlife habitat: The extensive old-growth forest has historically supported an old-growth dependent wildlife community. Early seral stages (clearcuts) will be important to a wide range of species, including grizzly bear, black bear, deer, moose, and elk.

Classification note: The 03 site series is not depicted on the edatopic grid, vegetation table, environment table, or site series key. This site series only occurs in the Kamloops Forest Region, around Wells Gray Park.

ICHwk1[a]

Edatopic Grid


Soil Nutrient Regime
Very Poor A
Poor B
Medium C
Rich D
Very Rich E
Soil Moisture Regime
Very Xeric 0
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02 Rhacomitrium - Cladonia b
04 HwCw - Falsebox - Feathermoss c
01 CwHw - Oak fern
05 CwHw - Devil's club - Lady fern
06 CwSxw - Devil's club - Horsetail
07 Act - Dogwood - Twinberry b
08 CwSxw - Skunk cabbage
09 Sedge - Sphagnum

---

[a] No 03 PlHw - Velvet-leaved blueberry recognized in Nelson Forest Region. This site series is only found near Wells Gray Park.

[b] Not recognized in Lloyd *et al.* (1990). Lloyd's 07 = 08, Lloyd's 08 = 09.

[c] Lloyd *et al.* (1990) 03 and 04 site series combined to form 04.

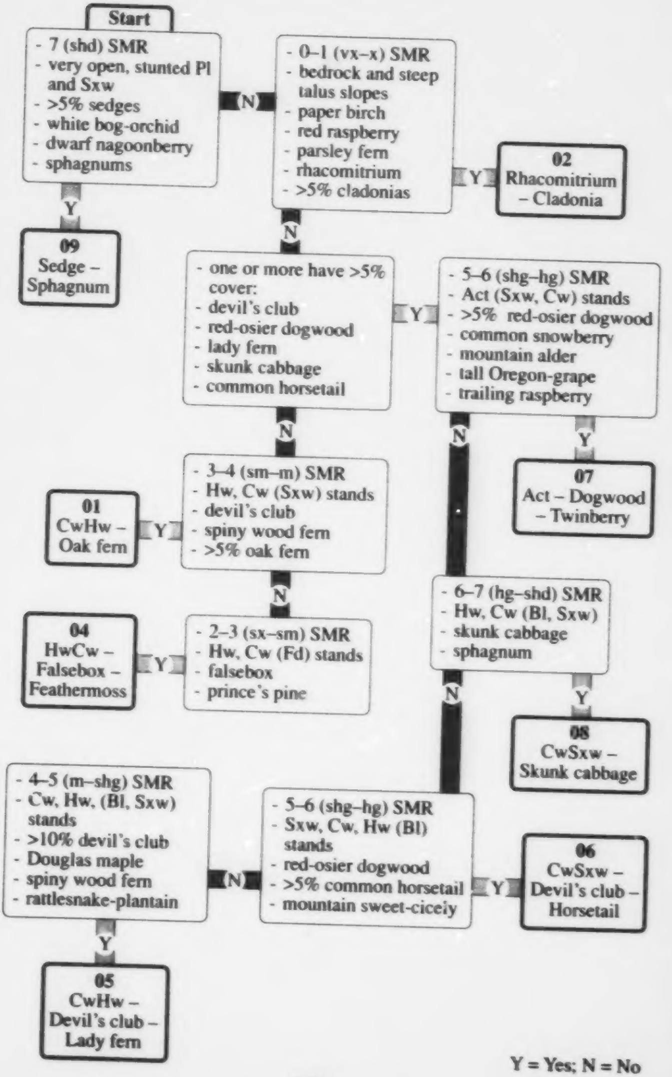
ICHwk1 Vegetation Table

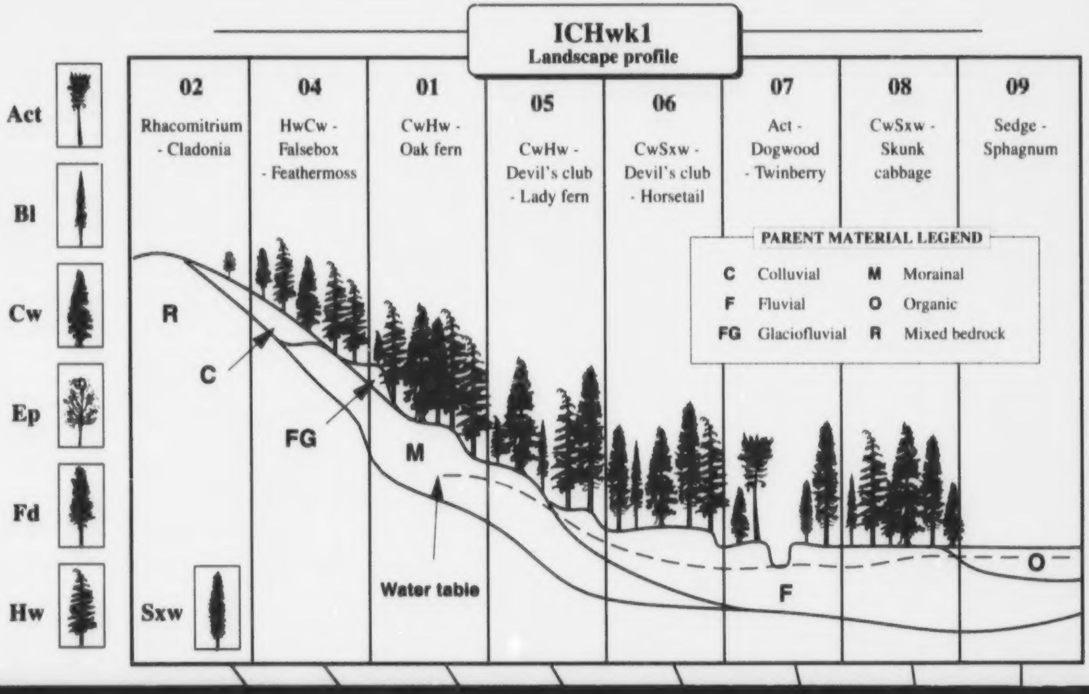
	Site Series	02	04	01	05	06	07	08	09	
TREES	*Pseudotsuga menziesii*		1 - 7%							Douglas-fir
	Betula papyrifera	<1%				<1%	1 - 7%			paper birch
	Tsuga heterophylla		>25%	>25%	15 - 25%	15 - 25%		>25%		western hemlock
	Thuja plicata		15 - 25%	15 - 25%	>25%	7 - 15%	<1%	15 - 25%		western redcedar
	Picea glauca x engelmannii		<1%	1 - 7%	1 - 7%	>25%	7 - 15%	1 - 7%	<1%	hybrid white spruce
	Abies lasiocarpa			<1%	1 - 7%	1 - 7%		1 - 7%		subalpine fir
	Populus balsamifera					1 - 7%	>25%	<1%		black cottonwood
SHRUBS	*Paxistima myrsinites*		7 - 15%	1 - 7%	<1%					falsebox
	Vaccinium ovalifolium		<1%	1 - 7%	1 - 7%	7 - 15%		7 - 15%		oval-leaved blueberry
	Oplopanax horridus			<1%	>25%	7 - 15%		1 - 7%		devil's club
	Rubus parviflorus				<1%	15 - 25%				thimbleberry
	Lonicera involucrata					7 - 15%	7 - 15%			black twinberry
	Cornus stolonifera					1 - 7%	>25%			red-osier dogwood
	Viburnum edule					1 - 7%	1 - 7%			highbush-cranberry
	Menziesia ferruginea		<1%	<1%				1 - 7%		false azalea
HERBS	*Cryptogramma crispa*	<1%								parsley fern
	Linnaea borealis		1 - 7%	<1%						twinflower
	Clintonia uniflora		1 - 7%	7 - 15%	1 - 7%	<1%	1 - 7%			queen's cup
	Tiarella trifoliata var. unifoliata		1 - 7%	7 - 15%	15 - 25%	1 - 7%		<1%		one-leaved foamflower
	Streptopus roseus		<1%	1 - 7%	1 - 7%	1 - 7%		1 - 7%		rosy twistedstalk
	Gymnocarpium dryopteris		<1%	7 - 15%	7 - 15%	7 - 15%				oak fern
	Rubus pedatus		<1%	1 - 7%	1 - 7%	1 - 7%				five-leaved bramble
	Dryopteris expansa			1 - 7%	1 - 7%					spiny wood fern
	Athyrium filix-femina			<1%	7 - 15%	7 - 15%		15 - 25%		lady fern
	Streptopus amplexifolius					1 - 7%		<1%		clasping twistedstalk
	Smilacina racemosa					1 - 7%	<1%			false Solomon's-seal
	Equisetum arvense					7 - 15%		1 - 7%		common horsetail
	Rubus pubescens						1 - 7%			trailing raspberry
	Lysichiton americanum							>25%		skunk cabbage
	Rubus arcticus								7 - 15%	dwarf nagoonberry
	Carex spp.								15 - 25%	sedges
MOSSES AND LICHENS	*Rhacomitrium* spp.	>25%								rock mosses
	Cladonia spp.	>25%								cladonias
	Cladina spp.	15 - 25%								cladinas
	Hylocomium splendens		15 - 25%	7 - 15%						step moss
	Rhytidiopsis robusta		7 - 15%	15 - 25%	1 - 7%	1 - 7%				pipecleaner moss
	Pleurozium schreberi		>25%	15 - 25%	1 - 7%	1 - 7%	<1%	1 - 7%	1 - 7%	red-stemmed feathermoss
	Mnium spp.			1 - 7%	7 - 15%	7 - 15%	<1%	7 - 15%		leafy mosses
	Sphagnum spp.							1 - 7%	>25%	sphagnums

Approximate Cover Classes: ▭ <1% ▭ 1 - 7% ▭ 7 - 15% ▭ 15 - 25% ▭ >25%

ICHwk1

Site Series Flowchart


Start
- 7 (shd) SMR
- very open, stunted Pl and Sxw
- >5% sedges
- white bog-orchid
- dwarf nagoonberry
- sphagnums
N
Y
09 Sedge – Sphagnum
- 0–1 (vx–x) SMR
- bedrock and steep talus slopes
- paper birch
- red raspberry
- parsley fern
- rhacomitrium
- >5% cladonias
Y
02 Rhacomitrium – Cladonia
N
- one or more have >5% cover:
- devil's club
- red-osier dogwood
- lady fern
- skunk cabbage
- common horsetail
Y
- 5–6 (shg–hg) SMR
- Act (Sxw, Cw) stands
- >5% red-osier dogwood
- common snowberry
- mountain alder
- tall Oregon-grape
- trailing raspberry
Y
07 Act – Dogwood – Twinberry
N
N
- 3–4 (sm–m) SMR
- Hw, Cw (Sxw) stands
- devil's club
- spiny wood fern
- >5% oak fern
Y
01 CwHw – Oak fern
N
- 2–3 (sx–sm) SMR
- Hw, Cw (Fd) stands
- falsebox
- prince's pine
Y
04 HwCw – Falsebox – Feathermoss
- 6–7 (hg–shd) SMR
- Hw, Cw (Bl, Sxw)
- skunk cabbage
- sphagnum
Y
08 CwSxw – Skunk cabbage
N
- 5–6 (shg–hg) SMR
- Sxw, Cw, Hw (Bl) stands
- red-osier dogwood
- >5% common horsetail
- mountain sweet-cicely
Y
06 CwSxw – Devil's club – Horsetail
N
- 4–5 (m–shg) SMR
- Cw, Hw, (Bl, Sxw) stands
- >10% devil's club
- Douglas maple
- spiny wood fern
- rattlesnake-plantain
Y
05 CwHw – Devil's club – Lady fern
Y = Yes; N = No

ICHwk1
Landscape profile
02
Rhacomitrium - Cladonia
04
HwCw - Falsebox - Feathermoss
01
CwHw - Oak fern
05
CwHw - Devil's club - Lady fern
06
CwSxw - Devil's club - Horsetail
07
Act - Dogwood - Twinberry
08
CwSxw - Skunk cabbage
09
Sedge - Sphagnum
PARENT MATERIAL LEGEND
C Colluvial
F Fluvial
FG Glaciofluvial
M Morainal
O Organic
R Mixed bedrock
R
C
FG
M
Water table
F
O
Act
Bl
Cw
Ep
Fd
Hw
Sxw

ICHwk1 Environmental Table

Site series		02	04	01	05	06	07	08	09
Number of plots		1	68	40	34	6	3	9	4
Soil moisture regime[a] (SMR)		0-1 vx-x	2-3 sx-sm	3-4 sm-m	4-5 m-shg	5-6 shg-hg	5-6 shg-hg	6-7 hg-shd	7 shd
Aspect		warm	variable	variable	variable	n.a.	n.a.	n.a.	n.a.
Slope gradient %		75	variable	0-45	variable	0-12	0	0-5	0
Slope position		crest-mid	variable	mid-toe, level	mid-toe	toe, level	level, dep.	lower, level, dep.	level, dep.
Parent material		C,R	M(FG,F)[b]	M(F, FG,C)	F,M,C (FG)	F	F	F	O
Soil texture coarse fragments % (min.-**mean**-max.)	0-30 cm	non-soil	L($,S) 4-**37**-62	L,$(S) 1-**38**-65	$,L(S) 0-**40**-65	S,$,L 0	S,L 0	L,C 2-**6**-10	organic (L) 0
	30+ cm	non-soil	S,L 10-**54**-87	S,L,$(C) 10-**41**-70	L,S,$(C) 28-**56**-80	S(L) 0-**27**-40	S 0	S,C 0-**1**-2	organic (L) 0
Humus form — LFH thickness cm (min.-**mean**-max.)		— 0	Mor (Moder) 1-**6**-18	Mor 2-**7**-20	Mor 2-**8**-38	Mor 2-**9**-29	Mor 2-**7**-12	all sat.[c] 1-**26**-54	organic soils
Important site features		talus or bedrock outcrops	some restricting layers; colluvial veneers common	—	some seepage 40-100 cm	high bench floodplain	medium bench floodplain sites	high water table (15-75 cm); organic veneers common	water table near surface (< 30 cm)

[a] Environmental features contained in this table are defined in Section 3.4.4.

[b] Values in brackets less common.

[c] Saturated Mors, Mulls, and Moders.

ICHwk1

Management Interpretations[a]

Site series	Number of plots	Common seedling growth limiting factors[a,b]	Relative tree productivity		Vegetation potential - common complexes[c]	Road drainage control needs (see cautions[a,c])	Common site sensitivities (see cautions[a,e])	Other prescription considerations
			Gross volume productivity	Growth class (site index, tree species)				
02	1	Dry soil, Nutrients	n.a.	n.a.	Low · mixed shrub	Mod.	VH displacement and forest floor hazard on all sites; H surface erosion hazard on all sites; VH mass wasting (dry ravelling) hazard on all sites	No timber values; Unfavorable substrate; Special road construction/maintenance; Conserve limited organic matter
04	68	Nutrients	High	Good (20, Sxw)	Low · fireweed	High	H forest floor displacement and surface erosion hazards on all sites; H mass wasting hazard on steep slopes; H displacement hazard on moderate slopes	Conserve limited organic matter; Special road construction/maintenance on steep slopes
01	40	Vegetation	High	Good (23, Sxw)	Medium · fireweed, mixed shrub, bracken	High	H forest floor and surface erosion hazards on moderate slopes; H mass wasting hazard on moderate slopes or silty soils	Brush prolific on flat sites; Conserve limited organic matter on moderate and steeper slopes; Special road construction/maintenance on silty soils or moderate and steeper slopes

05	34	Vegetation, Nutrients (on >60% slopes)	High	Good (22, Sxw)	High - mixed shrub, fireweed, bracken	Very high	H displacement, surface erosion, mass wasting and forest floor displacement on moderate slopes	Brush prolific on flat sites; Special road construction/maintenance on moderate and steeper slopes; Conserve limited organic matter on moderate and steeper slopes
06	6	Vegetation	High	Good (24, Sxw)	High - mixed shrub	Very high	H compaction hazard on silty soils	Windthrow hazard; Water table may rise post-harvest; Frost prone sites; Partial cutting questionable; Random machine travel on snowpack on silty soils
07	3	Vegetation	High	Good (24, Sxw)	High - cottonwood, mixed shrub, wet alder	Very high	.....	Windthrow hazard; Water table may rise post-harvest; Frost prone sites; Partial cutting questionable; Riparian
08	9	Vegetation, Wet soil, Cold air temp. (in depressions)	Med.	Good[f] (20, Sxw)	High - fern	Very high	VH compaction hazard on silty soils; H surface erosion and mass wasting hazards on clayey soils; H forest floor displacement hazard on clayey surface soils	Windthrow hazard; Water table may rise post-harvest; Frost prone sites; Partial cutting questionable; Conserve organic matter on clayey soils; Special road construction/maintenance on clayey soils; Random machine travel on clayey soils on snowpack; Riparian
09	4	Wet soil, Cold air temp	n.a.	n.a.	Medium - sedge	Very high	H compaction and displacement hazards on organic soils	No timber values; Riparian

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[a] **Caution**: Based on sample plot data; some interpretations expected to vary with individual site conditions. Use of original interpretive tools is necessary; these interpretations are presented here to "red flag" common concerns. This table outlines key considerations that should go into management decisions. Rationale and interpretive tools are discussed in Section 3.6.

[b] These include air temperature, soil temperature, vegetation, soil moisture, and soil nutrients; use of SYTEPREP recommended, see Section 3.6.1.

[c] Complexes described in Newton and Comeau (1990).

[d] **Caution**: This is presented here to "red flag" common drainage needs and is not intended to substitute for site specific engineering interpretations, see Section 3.6.4.

[e] **Caution**: Site sensitivity keys must be used with your site data for the PHSP; see Section 3.6.5. VH = very high, H = high, 30 - 45% = moderate slope, >45% = steep slope.

[f] Sample size less than five plots for site index determination.

ICHvk1

Variant Summary

Mica Very Wet Cool Interior Cedar - Hemlock Variant

Location: Valley bottoms and lower slopes in the northern Selkirk and Monashee mountains, north of the Goldstream River to Mica Creek. Upper ends of Downie and Kirkup creeks and Jordan, Wolsey, and Tangiers rivers. This variant is also found in the Kamloops Forest Region.

Elevation range: 550 to 1350 m (south aspect); 550 to 1250 m (north aspect).

Climate[31]: Wet Climatic Region; warm, wet summers; cold winters with heavy snowfall. Soils generally do not dry out in late summer, except for a short period on dry sites. Moderate to deep snowpacks of moderate duration prevent soils from freezing to a significant depth, often even when the soil is bladed, due to frequent snowfalls.

Soils, geology, and landforms: Rock types in the Selkirk Mountain areas of the ICHvk1 include quartzite, limestone, phyllite, sandstone, conglomerate, and quartz monzonite. Monashee Mountain areas of this variant have gneiss, schist, and granitic bedrock. Morainal soils with loamy to silty surface textures are common on lower to upper slopes. These slope positions have smaller areas of glaciofluvial soils with sandy to loamy surface textures. Fluvial soils with loamy, silty, or sandy surface textures occur on lower to level slope positions. Colluvial soils with loamy to sandy textures generally occur on upper slopes. Wet sites with frequent windthrow are characterized by soil mixing.

Zonal vegetation: Climax zonal sites have Hw and Cw stands. Sxw is the most common seral species. High cover of devil's club is common. Oak fern, lady fern, spiny wood fern, and one-leaved foamflower are the dominant herbs.

Distinguishing the ICHvk1 from adjacent subzones/variants

In the **ESSFwc2** most sites have:	- white-flowered rhododendron and mountain arnica - no Hw, Cw, enchanter's nightshade, or Hooker's fairybells
In the **ICHwk1** zonal sites have:	- no enchanter's nightshade - more falsebox, Utah honeysuckle, and twinflower - less (<10%) devil's club and lady fern
dry sites have:	- no spiny wood fern
In the **ESSFvc** most sites have:	- Hm, white-flowered rhododendron and heart-leaved twayblade - no Pw, Douglas maple, Hooker's fairybells, or step moss - more Bl - less Cw, enchanter's nightshade, bunchberry, rattlesnake-plantain, or knight's plume
zonal sites also have:	- more false azalea - less devil's club
dry sites have:	- more western yew, wild sarasparilla, and cladinas

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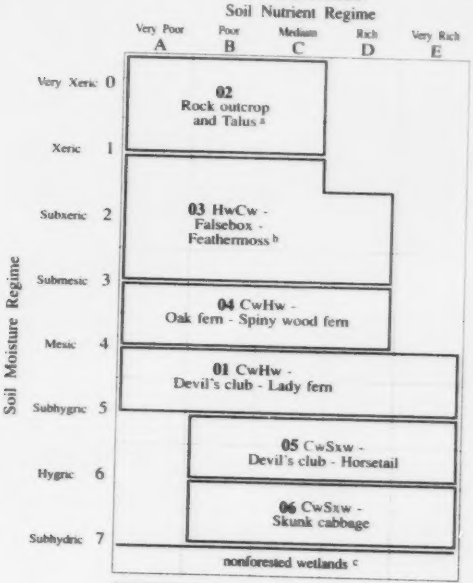
[31] Values for climate descriptors given in Appendix 12.

wet sites have:
- mountain hairgrass and glow moss
- more Brewer's mitrewort, Sitka valerian, and arrow-leaved groundsel (these herbs are also more common on mesic sites)
- less red-osier dogwood

Forest characteristics: Due to the rarity of wildfires, climax old-growth stands of Cw and Hw are abundant. Windthrow, insects, and disease are the major natural disturbances. Prolific growth of the mixed shrubs or fern vegetation complexes commonly occurs on zonal and wetter sites after harvest.

Wildlife habitat: Extensive old-growth forests support a range of old-growth dependent species. Maintenance of enough old-growth forest to preserve these species is important. Caribou and grizzly bears are particularly important in these habitats. Winter range is severely constrained by very deep winter snow.

ICHvk1
Edatopic Grid


Soil Nutrient Regime
Very Poor A
Poor B
Medium C
Rich D
Very Rich E
Soil Moisture Regime
Very Xeric 0
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02 Rock outcrop and Talus a
03 HwCw - Falsebox - Feathermoss b
04 CwHw - Oak fern - Spiny wood fern
01 CwHw - Devil's club - Lady fern
05 CwSxw - Devil's club - Horsetail
06 CwSxw - Skunk cabbage
nonforested wetlands c

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[a] 02 site series not sampled or described.

[b] 03 site series numbered 02 in Lloyd *et al.* (1990).

[c] Nonforested wetlands not sampled or described.

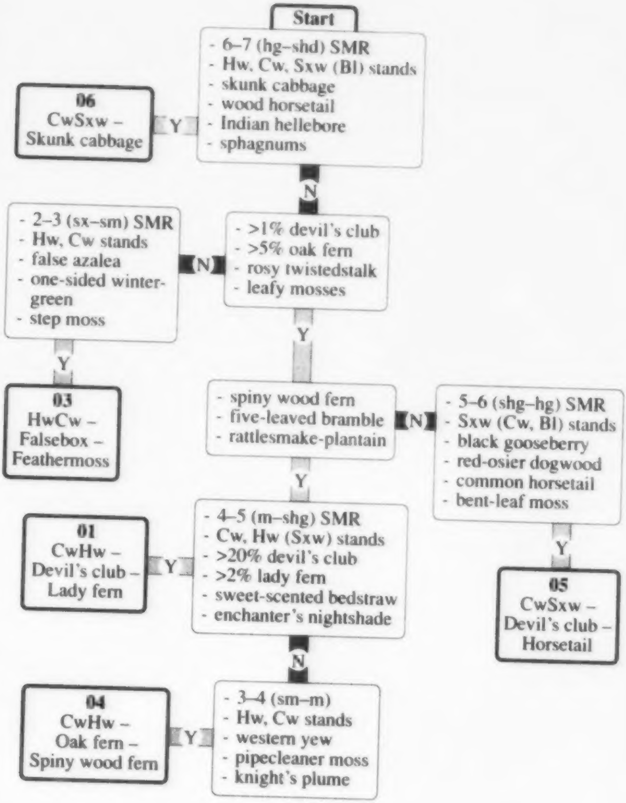
ICHvk1 Vegetation Table

	Site Series	03	04	01	05	06	
TREES	*Thuja plicata*	15 - 25%	>25%	>25%	7 - 15%	15 - 25%	western redcedar
	Tsuga heterophylla	>25%	>25%	>25%	<1%	>25%	western hemlock
	Picea glauca x engelmannii	<1%	<1%	1 - 7%	>25%	7 - 15%	hybrid white spruce
	Abies lasiocarpa	1 - 7%			<1%	<1%	subalpine fir
SHRUBS	*Paxistima myrsinites*	<1%	<1%				falsebox
	Taxus brevifolia	<1%	1 - 7%	<1%			western yew
	Menziesia ferruginea	1 - 7%	<1%	<1%		<1%	false azalea
	Vaccinium ovalifolium	1 - 7%	1 - 7%	1 - 7%	7 - 15%	<1%	oval-leaved blueberry
	Vaccinium membranaceum	1 - 7%	<1%	1 - 7%	1 - 7%		black huckleberry
	Oplopanax horridus		1 - 7%	>25%	15 - 25%	<1%	devil's club
	Ribes lacustre			<1%	1 - 7%		black gooseberry
	Cornus stolonifera				7 - 15%		red-osier dogwood
HERBS	*Orthilia secunda*	<1%			<1%		one-sided wintergreen
	Goodyera oblongifolia		<1%				rattlesnake-plantain
	Cornus canadensis	7 - 15%	7 - 15%	1 - 7%		1 - 7%	bunchberry
	Clintonia uniflora	1 - 7%	1 - 7%	1 - 7%	<1%		queen's cup
	Rubus pedatus	<1%	1 - 7%	1 - 7%		<1%	five-leaved bramble
	Gymnocarpium dryopteris	<1%	>25%	>25%	15 - 25%	<1%	oak fern
	Tiarella trifoliata var. unifoliata	<1%	15 - 25%	15 - 25%	1 - 7%	<1%	one-leaved foamflower
	Dryopteris expansa		15 - 25%	15 - 25%	1 - 7%		spiny wood fern
	Streptopus roseus		1 - 7%	1 - 7%	1 - 7%		rosy twistedstalk
	Viola spp.		<1%	<1%	1 - 7%	<1%	violets
	Smilacina racemosa		<1%	<1%	<1%		false Solomon's-seal
	Athyrium filix-femina			>25%	7 - 15%	>25%	lady fern
	Circaea alpina			1 - 7%		1 - 7%	enchanter's nightshade
	Galium triflorum				1 - 7%		sweet-scented bedstraw
	Streptopus amplexifolius				1 - 7%		clasping twistedstalk
	Equisetum arvense				15 - 25%		common horsetail
	Lysichiton americanum					>25%	skunk cabbage
MOSSES AND LICHENS	*Barbilophozia lycopodioides*	<1%					common leafy liverwort
	Hylocomium splendens	15 - 25%	1 - 7%			1 - 7%	step moss
	Pleurozium schreberi	>25%	7 - 15%	<1%	1 - 7%	1 - 7%	red-stemmed feathermoss
	Ptilium crista-castrensis	7 - 15%	1 - 7%	<1%	<1%	1 - 7%	knight's plume
	Rhytidiopsis robusta	7 - 15%	15 - 25%	1 - 7%		1 - 7%	pipecleaner moss
	Mnium spp.		1 - 7%	7 - 15%	>25%	>25%	leafy mosses
	Rhytidiadelphus squarrosus				>25%		bent-leaf moss
	Sphagnum spp.					>25%	sphagnums
	Pellia spp.					1 - 7%	pellia liverworts

Approximate Cover Classes: ▯ <1% ▭ 1 - 7% ▭ 7 - 15% ▭ 15 - 25% ▭ >25%

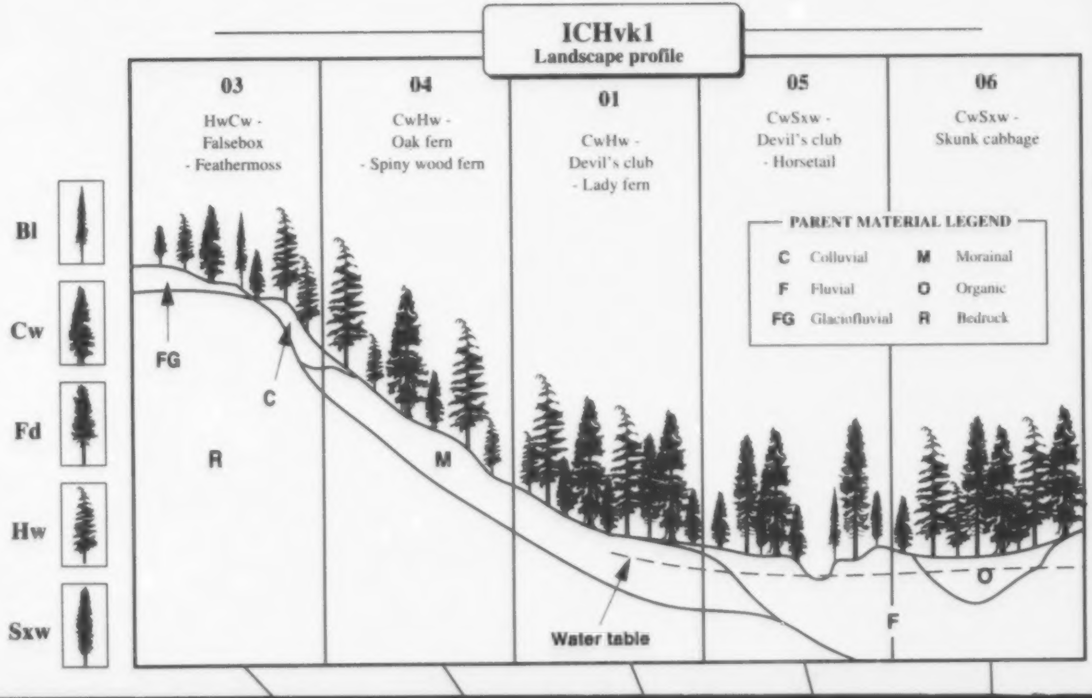
ICHvk1

Site Series Flowchart


Start
- 6–7 (hg–shd) SMR
- Hw, Cw, Sxw (Bl) stands
- skunk cabbage
- wood horsetail
- Indian hellebore
- sphagnums
Y
06
CwSxw – Skunk cabbage
N
- >1% devil's club
- >5% oak fern
- rosy twistedstalk
- leafy mosses
N
- 2–3 (sx–sm) SMR
- Hw, Cw stands
- false azalea
- one-sided wintergreen
- step moss
Y
03
HwCw – Falsebox – Feathermoss
Y
- spiny wood fern
- five-leaved bramble
- rattlesmake-plantain
N
- 5–6 (shg–hg) SMR
- Sxw (Cw, Bl) stands
- black gooseberry
- red-osier dogwood
- common horsetail
- bent-leaf moss
Y
05
CwSxw – Devil's club – Horsetail
Y
- 4–5 (m–shg) SMR
- Cw, Hw (Sxw) stands
- >20% devil's club
- >2% lady fern
- sweet-scented bedstraw
- enchanter's nightshade
Y
01
CwHw – Devil's club – Lady fern
N
- 3–4 (sm–m)
- Hw, Cw stands
- western yew
- pipecleaner moss
- knight's plume
Y
04
CwHw – Oak fern – Spiny wood fern

Y = Yes; N = No

ICHvk1
Landscape profile


Bl
Cw
Fd
Hw
Sxw
03
HwCw -
Falsebox
- Feathermoss
04
CwHw -
Oak fern
- Spiny wood fern
01
CwHw -
Devil's club
- Lady fern
05
CwSxw -
Devil's club
- Horsetail
06
CwSxw -
Skunk cabbage
PARENT MATERIAL LEGEND
C Colluvial
M Morainal
F Fluvial
O Organic
FG Glaciofluvial
R Bedrock
FG
C
R
M
Water table
O
F

ICHvk1 Environmental Table

Site series		03	04	01	05	06
Number of plots		9	28	25	5	4
Soil moisture regime[a] (SMR)		2-3 sx-sm	3-4 sm-m	4-5 m-shg	5-6 shg-hg	6-7 hg-shd
Aspect		variable	variable	variable	n.a.	n.a.
Slope gradient %		variable	variable	variable	0-18	0-25
Slope position		variable	mid-lower	mid-lower, (level)	level, toe	toe, level
Parent material		FG,C,M	M(FG,F)[b]	M,F(FG)	F	O,F,L,C
Soil texture coarse fragments % (min.-**mean**-max.)	0-30 cm	L(S,$,C) 20-**51**-75	L(S,$) 5-**34**-60	$,L 6-**29**-50	$,L(S) 8-**18**-20	organic C(L) 0-**31**-68
	30+ cm	L,S(C,$) 35-**60**-79	S(L,$) 24-**45**-62	L,S($) 18-**45**-70	$,L(S) 10-**24**-30	organic C(L) 0-**20**-35
Humus form — LFH thickness cm (min.-**mean**-max.)		Mor 5-**11**-24	Mor 0-**7**-12	Mor 2-**8**-16	Mor 5-**8**-13	all 1-**15**-37
Important site features		some restricting layers	colluvial veneers	—	—	some organic veneers; water table 5-70 cm

[a] Environmental features contained in this table are defined in Section 3.4.4.

[b] Values in brackets less common.

ICHvk1

Management Interpretations[a]

Site series	Number of plots	Common seedling growth limiting factors[a,b]	Relative tree productivity		Vegetation potential - common complexes[c]	Road drainage control needs (see cautions[a,c])	Common site sensitivities (see cautions[a,d])	Other prescription considerations
			Gross volume productivity	Growth class (site index, tree species)				
03	9	Vegetation, Nutrients (on slopes >60%)	High	Good (19, Sxw)	Medium - mixed shrub, fireweed, bracken	High	H erosion and forest floor displacement hazard on all sites; H mass wasting hazard on moderate slopes; H displacement hazard on very steep slopes	Conserve limited organic matter; Special road construction/maintenance on moderate and steeper slopes
04	28	Vegetation, Nutrients (on slopes >60%)	High	Good (23, Sxw)	Medium - mixed shrub, fireweed, bracken	High	H displacement, erosion and forest floor displacement on moderate slopes	Conserve limited organic matter
01	25	Vegetation, Nutrients (on slopes >60%)	High	Good (22, Sxw)	High - mixed shrub, fireweed, bracken	Very high	H displacement, erosion, mass wasting hazards on moderate slopes; H forest floor displacement hazard on moderate slopes	Brush more prolific on flat sites; Special road construction/maintenance on moderate and steeper slopes; Conserve limited organic matter on moderate slopes with silty soils

05	5	Vegetation, Cold air temp.	High	Good (24, Sxw)	High - mixed shrub	Very high	H compaction hazard on silty soils	Windthrow hazard; Water table may rise post-harvest; Flat sites frost prone; Partial cutting questionable; Random machine travel on snow on silty soils; Riparian
06	4	Wet soil	Med.	Good[f] (20, Sxw)	High - fern, mixed shrub	Very high	VH compaction hazard on clayey and organic soils; H-VH displacement hazard on organic soils; H road cut/fill mass wasting hazard on clayey soil	Windthrow hazard; Water table may rise post-harvest; Flat sites frost prone; Partial cutting questionable; Random machine travel on snow on clayey or organic soils; Soil never dries; Unfavourable substrate on clayey soils; Special road construction/maintenance on clayey soils; Riparian

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[a] **Caution**: Based on sample plot data; some interpretations expected to vary with individual site conditions. Use of original interpretive tools is necessary; these interpretations are presented here to "red flag" common concerns. This table outlines key considerations that should go into management decisions. Rationale and interpretive tools are discussed in Section 3.6.

[b] These include air temperature, soil temperature, vegetation, soil moisture, and soil nutrients; use of SYTEPREP recommended, see Section 3.6.1.

[c] Complexes described in Newton and Comeau (1990).

[d] **Caution**: This is presented here to "red flag" common drainage needs and is not intended to substitute for site specific engineering interpretations, see Section 3.6.4.

[e] **Caution**: Site sensitivity keys must be used with your site data for the PHSP; see Section 3.6.5. **VH** = very high, **H** = high, 30 - 45% = moderate slope, 45 - 60% = steep slope, >60% = very steep slope.

[f] Sample size less than five plots for site index determination.

ESSFvc

Subzone Summary

Very Wet Cold Engelmann Spruce - Subalpine Fir Subzone

Location: Mid to upper slopes of the northern Selkirk and Monashee mountains, north of the Trans-Canada Highway to Mica Creek. Extends along valley bottoms in some drainages where icefields, glaciers, and cold air drainage modify the climate. This subzone also occurs in the Kamloops Forest Region.

Elevation range: 1350 to 1800 m (south aspect); 1250 to 1800 m (north aspect).

Climate[32]**:** Wet Climatic Region; cool, very wet summers; very cold winters with very heavy snowfall. Soils are not expected to dry out for an extended period on any site. Snowpacks are very deep and of very long duration, preventing the soil from freezing. This often occurs even if the soil is bladed, due to frequent snowfalls. Cold soil, frost, and late lying snow are the major climatic limitations to tree growth.

Soils, geology, and landforms: In the Selkirk Mountain area of the ESSFvc, bedrock consists of quartzite, granodiorite, sandstone, conglomerate, limestone, and argillite. Rock types in the Monashee Mountain area of this subzone include gneiss, schist, amphibolite, and marble. Morainal soils with loamy surface textures occur on lower to crest slope positions. Fluvial soils with loamy textures cover lower and level slopes; these soils often have strongly contrasting textures at depth. Some colluvial soils with sandy or silty textures are found on steep, upper slopes. Minor glaciofluvial soils with sandy or loamy textures occur in proximity to morainal soils on level and toe slopes. In this subzone, rooting is often restricted by shallow bedrock, permanent seepage, or high water tables; these soils have a high windthrow hazard.

Zonal vegetation: Zonal sites have Bl, Se, and Hm stands. White-flowered rhododendron, black huckleberry, oval-leaved blueberry, and false azalea are the most common shrubs. Herbs include oak fern, mountain valerian, and five-leaved bramble.

Distinguishing the ESSFvc from adjacent subzones/variants

In the **ESSFwc1** most sites have:	- no Hm - more Cw, Hw, falsebox, thimbleberry, Utah honeysuckle, and rattlesnake-plantain - less false azalea and arrow-leaved groundsel
dry sites have:	- Pl - no partridgefoot
In the **ESSFwc4** most sites have:	- no Hm - less false Solomon's-seal and rosy twistedstalk
dry sites have:	- Pl and grouseberry - no partridgefoot
In the **ESSFwc2** most sites have:	- no Hm
zonal sites also have:	- no spiny wood fern or lady fern
In the ICHvk1 and **ICHwk1** most sites have:	- Pw, Cw, and Hw - no Hm - more Douglas maple, western yew, red-osier dogwood, enchanter's nightshade, bunchberry, rattlesnake-plantain, wild sarsaparilla, Hooker's fairybells, knight's plume, and step moss - less Bl, heart-leaved twayblade, and white-flowered rhododendron

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[32] Values for climate descriptors given in Appendix 12.

zonal sites also have:	- more devil's club - less false azalea
dry sites have:	- Fd - less cladonias
zonal and wetter sites have:	- less Brewer's mitrewort, Sitka valerian, and arrow-leaved groundsel
wet sites have:	- less mountain hairgrass

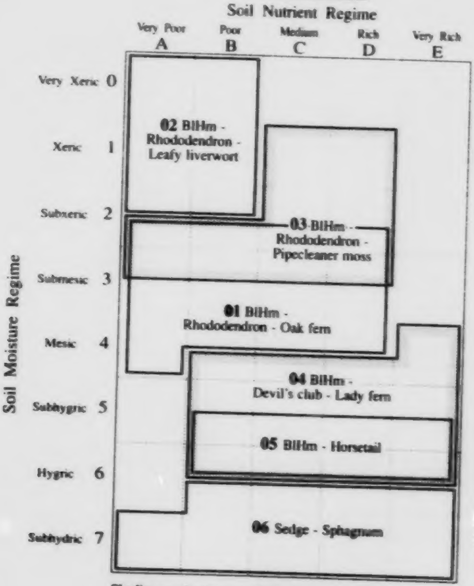
Forest characteristics: Abundant precipitation has limited wildfires so that extensive older climax stands are frequent. Windthrow, insects, and diseases are the main disturbance agents.

The lower transition to the ICH is very brushy with prolific growth of Sitka alder. The upper transition to the parkland, at about 1800 m, is important to note. This transition is indicated by mountain-heathers and tree islands. Tree growth and regeneration become very difficult.

Wildlife habitat: This subzone includes important late winter range for caribou. It is also critical habitat for marten. Much of this subzone has old-growth stands which are important for biodiversity.

ESSFvc

Edatopic Grid



Soil Nutrient Regime
Very Poor A
Poor B
Medium C
Rich D
Very Rich E
Soil Moisture Regime
Very Xeric 0
Xeric 1
Subxeric 2
Submesic 3
Mesic 4
Subhygric 5
Hygric 6
Subhydric 7
02 BlHm - Rhododendron - Leafy liverwort
03 BlHm - Rhododendron - Pipecleaner moss
01 BlHm - Rhododendron - Oak fern
04 BlHm - Devil's club - Lady fern
05 BlHm - Horsetail
06 Sedge - Sphagnum

Shading used where considerable site series overlap occurs.

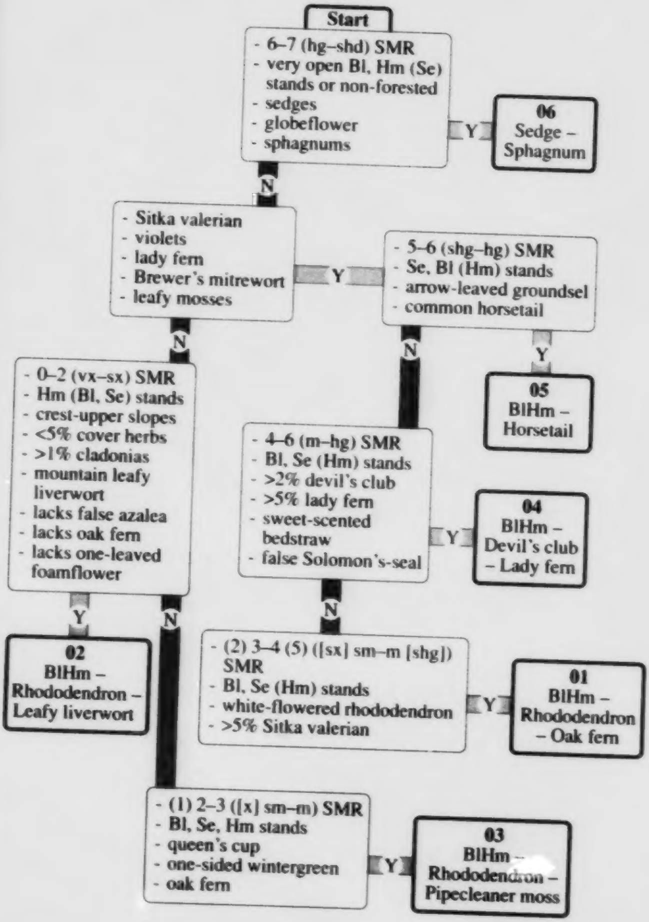
ESSFvc Vegetation Table

	Site Series	02	03	01	04	05	06	Common Name
TREES	*Abies lasiocarpa*	7 - 15%	>25%	15 - 25%	>25%	15 - 25%	1 - 7%	subalpine fir
	Tsuga mertensiana	>25%	>25%	7 - 15%	<1%	7 - 15%	1 - 7%	mountain hemlock
	Picea engelmannii	1 - 7%	15 - 25%	15 - 25%	>25%	15 - 25%	<1%	Engelmann spruce
SHRUBS	*Vaccinium membranaceum*	7 - 15%	15 - 25%	15 - 25%	15 - 25%	7 - 15%	<1%	black huckleberry
	Rhododendron albiflorum	15 - 25%	7 - 15%	15 - 25%	<1%	1 - 7%	1 - 7%	white-flowered rhododendron
	Vaccinium ovalifolium	<1%	1 - 7%	7 - 15%	7 - 15%	7 - 15%	1 - 7%	oval-leaved blueberry
	Menziesia ferruginea		7 - 15%	7 - 15%	7 - 15%	7 - 15%		false azalea
	Oplopanax horridus				15 - 25%			devil's club
	Ribes lacustre				<1%	1 - 7%		black gooseberry
	Rubus parviflorus				1 - 7%			thimbleberry
	Sambucus racemosa				1 - 7%			red elderberry
HERBS	*Luzula parviflora*	<1%		<1%				small-flowered woodrush
	Rubus pedatus	1 - 7%	7 - 15%	7 - 15%	1 - 7%	1 - 7%		five-leaved bramble
	Streptopus roseus		1 - 7%	1 - 7%	1 - 7%	1 - 7%	<1%	rosy twistedstalk
	Tiarella trifoliata var. unifoliata		1 - 7%	1 - 7%	7 - 15%	1 - 7%		one-leaved foamflower
	Gymnocarpium dryopteris		7 - 15%	15 - 25%	15 - 25%	7 - 15%	<1%	oak fern
	Clintonia uniflora		1 - 7%	1 - 7%	<1%			queen's cup
	Valeriana sitchensis			15 - 25%	1 - 7%	7 - 15%	<1%	Sitka valerian
	Veratrum viride			<1%	<1%			Indian hellebore
	Mitella breweri			<1%	1 - 7%	<1%		Brewer's mitrewort
	Dryopteris expansa			1 - 7%	15 - 25%			spiny wood fern
	Viola spp.			<1%	1 - 7%	<1%	<1%	violets
	Athyrium filix-femina			1 - 7%	>25%	1 - 7%		lady fern
	Galium triflorum				<1%			sweet-scented bedstraw
	Smilacina racemosa				<1%			false Solomon's-seal
	Streptopus amplexifolius				<1%	1 - 7%	<1%	clasping twistedstalk
	Equisetum arvense					15 - 25%	<1%	common horsetail
	Senecio triangularis					1 - 7%	7 - 15%	arrow-leaved groundsel
	Carex spp.						7 - 15%	sedges
	Trollius laxus						1 - 7%	globe flower
MOSSES, LICHENS AND LIVERWORTS	*Cladonia* spp.	1 - 7%						cladonias
	Dicranum spp.	15 - 25%	1 - 7%	7 - 15%	<1%		<1%	dicranum mosses
	Barbilophozia floerkii	15 - 25%		<1%			1 - 7%	mountain leafy liverwort
	Pleurozium schreberi	1 - 7%	7 - 15%	1 - 7%	7 - 15%	1 - 7%	<1%	red-stemmed feathermoss
	Rhytidiopsis robusta	1 - 7%	7 - 15%	1 - 7%	1 - 7%	<1%		pipecleaner moss
	Barbilophozia lycopodioides	7 - 15%	7 - 15%	1 - 7%	1 - 7%	1 - 7%		common leafy liverwort
	Mnium spp.			1 - 7%	7 - 15%	15 - 25%	1 - 7%	leafy mosses
	Aulacomnium palustre					1 - 7%	1 - 7%	glow moss
	Sphagnum spp.						15 - 25%	sphagnums

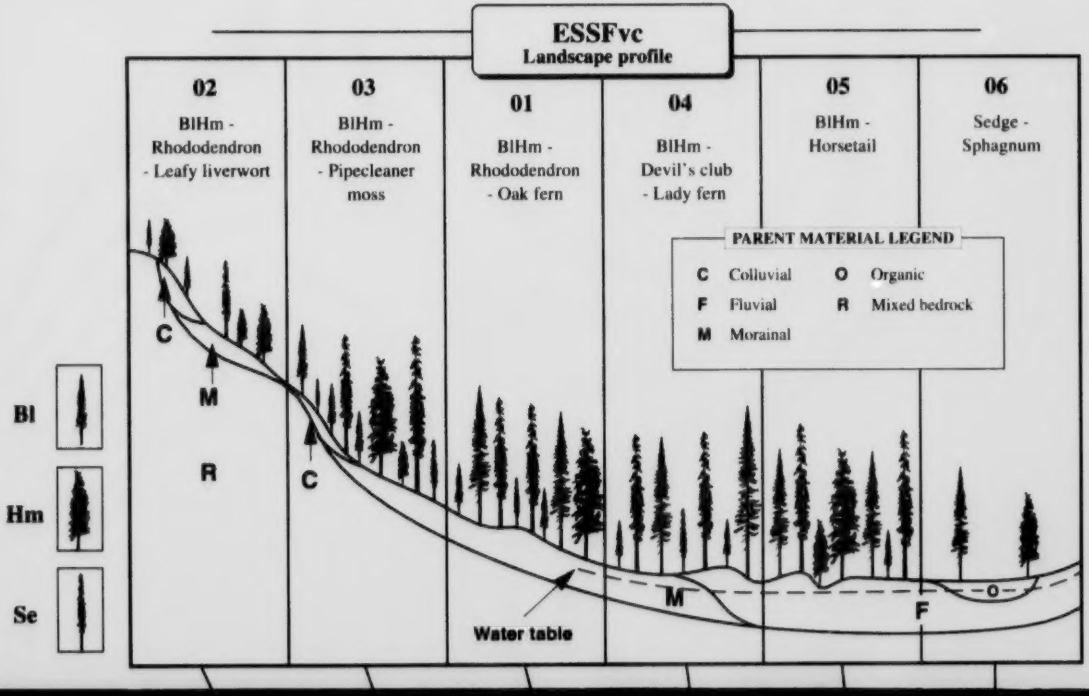
Approximate Cover Classes: <1% 1 - 7% 7 - 15% 15 - 25% >25%

ESSFvc

Site Series Flowchart


Start
- 6–7 (hg–shd) SMR
- very open Bl, Hm (Se) stands or non-forested
- sedges
- globeflower
- sphagnums
Y
06 Sedge – Sphagnum
N
- Sitka valerian
- violets
- lady fern
- Brewer's mitrewort
- leafy mosses
Y
- 5–6 (shg–hg) SMR
- Se, Bl (Hm) stands
- arrow-leaved groundsel
- common horsetail
Y
05 BlHm – Horsetail
N
- 4–6 (m–hg) SMR
- Bl, Se (Hm) stands
- >2% devil's club
- >5% lady fern
- sweet-scented bedstraw
- false Solomon's-seal
Y
04 BlHm – Devil's club – Lady fern
N
- (2) 3–4 (5) ([sx] sm–m [shg]) SMR
- Bl, Se (Hm) stands
- white-flowered rhododendron
- >5% Sitka valerian
Y
01 BlHm – Rhododendron – Oak fern
N
- 0–2 (vx–sx) SMR
- Hm (Bl, Se) stands
- crest-upper slopes
- <5% cover herbs
- >1% cladonias
- mountain leafy liverwort
- lacks false azalea
- lacks oak fern
- lacks one-leaved foamflower
Y
02 BlHm – Rhododendron – Leafy liverwort
N
- (1) 2–3 ([x] sm–m) SMR
- Bl, Se, Hm stands
- queen's cup
- one-sided wintergreen
- oak fern
Y
03 BlHm – Rhododendron – Pipecleaner moss

Y = Yes; N = No


ESSFvc
Landscape profile
02
BlHm - Rhododendron - Leafy liverwort
03
BlHm - Rhododendron - Pipecleaner moss
01
BlHm - Rhododendron - Oak fern
04
BlHm - Devil's club - Lady fern
05
BlHm - Horsetail
06
Sedge - Sphagnum
PARENT MATERIAL LEGEND
C Colluvial
F Fluvial
M Morainal
O Organic
R Mixed bedrock
C
M
R
C
Water table
M
F
O
Bl
Hm
Se

ESSFvc Environmental Table

Site series		02	03	01	04	05	06
Number of plots		9	10	21	14	8	9
Soil moisture regime[a] (SMR)		0-2 vx-sx	(1)[b]2-3 (x)sx-sm	(2)3-4(5) (sx)sm-m(shg)	4-6 m-hg	5-6(7) shg-hg(shd)	6-7 hg-shd
Aspect		variable	variable	variable	variable	variable	variable
Slope gradient %		variable	variable	7-45	5-35	0-25	0-25
Slope position		crest-upper	upper-mid	mid (lower, toe)	mid-lower (toe)	mid-toe (level)	lower-level, & depression
Parent material		M (C)	M (C)	M	M(F)	F	O,F(M)
Soil texture coarse fragments % (min.-**mean**-max.)	0-30 cm	L(S,$) 20-**47**-70	L 28-**42**-55	L 10-**32**-60	L($) 10-**29**-42	L(S,$) 0-**21**-50	organic or L,$(S) 0-**18**-30
	30+ cm	L(S,$) 70-**73**-80	L($,C) 40-**57**-70	L(S) 30-**51**-75	L,$ 18-**42**-70	S,$,L(C) 15-**36**-65	organic or L(S,$) 0-**25**-45
Humus form — LFH thickness cm (min.-**mean**-max.)		Mor 2-**9**-17	Mor 1-**7**-20	Mor (Moder) 2-**7**-32	Mor 2-**11**-40	Mor 2-**6**-15	saturated Mors, Moders 0-**26**-70
Important site features		restricting layers common	—	some temporary seepage or water table 25-100 cm	sites with seepage (15-50 cm) common	high water table	water table < 30 cm

[a] Environmental features contained in this table are defined in Section 3.4.4.
[b] Values in brackets less common.

ESSFvc

Management Interpretations[a]

Site series	Number of plots	Common seedling growth limiting factors[a,b]	Relative tree productivity		Vegetation potential - common complexes[c]	Road drainage control needs (see cautions[a,e])	Common site sensitivities (see cautions[a,e])	Other prescription considerations[f]
			Gross volume productivity	Growth class (site index, tree species)				
02	9	Cold soil, Nutrients	Med.	Medium (15, Se)	Low - ericaceous shrub, fireweed	Mod.	H forest floor displacement hazard and mass wasting on all sites; H displacement hazard on moderate slopes	Conserve limited organic matter; Special road construction/maintenance
03	10	Cold soil, Vegetation, Nutrients (on slopes >60%)	Med.	Medium (14, Se)	Medium - ericaceous shrub, fireweed	High	H surface erosion and mass wasting hazard on all sites; H displacement hazard on steep slopes; H forest floor displacement hazard on moderate slopes	Special road construction/maintenance; Conserve limited organic matter on moderate and steep slopes
01	21	Cold soil, Cold air temp., Vegetation	Med.	Medium (15, Se)	Medium - ericaceous shrub, fireweed, subalpine herb	High	H surface erosion, mass wasting and forest floor displacement hazard on all sites	Conserve limited organic matter; Special road construction/maintenance

04	14	Cold air temp., Cold soil, Vegetation, Nutrients (where water table 15-30cm)	Med.	Good (17, Se)	High - ericaceous shrub, fern, fireweed	Very high	H surface erosion and mass wasting hazard on all sites; H displacement hazard on sites with near surface water tables (<30cm); H forest floor displacement hazard on sites with moderate slope and/or near surface water tables (<30cm)	Windthrow hazard; Water table may rise post-harvest; Special road construction /maintenance; Unfavourable substrate when shallow water table; Conserve limited organic matter; Wet soils have H compaction hazards; Riparian
05	8	Cold air temp., Cold soil, Wet soil, Vegetation	Med.	Good (16, Se)	High - ericaceous shrub, subalpine herb	Very high	H surface erosion, road cut/fill mass wasting and forest floor displacement hazard on all sites	Windthrow hazard; Water table may rise post-harvest; Frost prone sites; Conserve organic matter; Special road construction/maintenance; Riparian
06	9	Cold air temp., Cold soil, Nutrients (where water table 15-30cm)	Non-forested to Low	Medium (13, Se)	Medium - ericaceous shrub	Very high	H surface erosion and road cut/fill mass wasting hazard on all sites; H compaction hazard on silty soils	No timber values; Special road construction /maintenance; Random machine travel on silty soils on snowpack; Riparian

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[a] **Caution:** Based on sample plot data; some interpretations expected to vary with individual site conditions; Use of original interpretive tools is necessary; these interpretations are presented here to "red flag" common concerns. This table outlines key considerations that should go into management decisions. Rationale and interpretive tools are discussed in Section 3.6.

[b] These include air temperature, soil temperature, vegetation, soil moisture, and soil nutrients; use of SYTEPREP recommended, see Section 3.6.1.

[c] Complexes described in Newton and Comeau (1990).

[d] **Caution**: This is presented here to "red flag" common drainage needs and is not intended to substitute for site specific engineering interpretations, see Section 3.6.4.

[e] **Caution**: Site sensitivity keys must be used with your site data for the PHSP; see Section 3.6.5. H = high, 30 - 45% = moderate slope, >45% = steep slope.

[f] Partial cutting or no harvesting recommended where regeneration restricted to tree islands (above approximately 1 750 m).

6 WILDLIFE DIVERSITY AND HABITAT RELATIONSHIPS

by

Christoph Steeger and Mike Fenger

6.1 Introduction

This field guide describes ecosystems in the Nelson Forest Region and it would be incomplete without a discussion of wildlife. They are as much a part of ecosystems as plants and play an important role in ecosystem function. This section provides a broad regional overview and complements the wildlife paragraphs within each subzone/variant summary page in Chapter 5.

The Nelson Forest Region supports a great abundance and diversity of wildlife species, including 70% of the bird species known to occur in British Columbia and 62% of the breeding birds of the province. This region contains one of the highest breeding concentrations of Ospreys[33] in the world and the only breeding location of Forster's Tern. It is also one of the few areas in British Columbia where the Western Grebe and Long-billed Curlew breed. The Black-billed Cuckoo occurs regularly. Significant autumn and winter populations of waterbirds, especially American Coots, are found on large ice-free lakes. The extensive waterbodies are important migration staging areas for Tundra Swans, Canada Geese, and dabbling and diving ducks, particularly Redhead. The area is the centre of breeding abundance for the White-breasted Nuthatch. Large flocks of Clark's Nutcracker appear in the valley bottoms during autumn and winter.

Mountain goats are perhaps the most widely distributed wild ungulate in the Nelson Forest Region. Mule and white-tailed deer are also widely distributed. Elk are very abundant and bighorn sheep are common throughout the mountains and valleys adjacent to the southern portion of the Rocky Mountain Trench. Small, relict populations of caribou occur in old-growth spruce forests in the Columbia Mountains and Highlands; the "Selkirk Herd" is the most southern population of caribou in the province. Grizzly and black bears are common throughout the area.

Common small mammals of the region include the long-eared myotis (bat), common pika, hoary marmot, Columbian ground squirrel, golden-mantled ground squirrel, and water vole. The painted turtle, common garter snake, and western garter snake are typical reptiles. The long-toed salamander, western toad, spotted leopard frog, and northern leopard frog are characteristic amphibians (Demarchi *et al.* 1990).

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[33] Bird common names are by convention capitalized.

The highest abundance and diversity of wildlife species within the Nelson Forest Region occurs in the East Kootenay. This area is unique in its capacity to support seven species of ungulates, many of which inhabit the same winter ranges. This diversity, coupled with the capacity to support large populations of most of these species as well as several species of carnivores, makes the East Kootenay a wildlife area of national significance (Demarchi 1986).

To protect and manage the province's wildlife resource, the B.C. Environment Wildlife Program has identified as its primary goal the conservation of biological diversity and proposes:

"to maintain and enhance wildlife and their habitats, and thus ensure an abundant, diverse and self-sustaining wildlife resource throughout British Columbia (B.C. Ministry of Environment 1991)."

Because much of B.C. is forested and many wildlife species have adapted to use forested habitats, the achievement of this goal will largely depend on the integration of forest and wildlife management. Forest road construction, timber harvesting, and silvicultural practices can strongly affect wildlife populations. Some species, such as white-tailed deer, benefit from the creation of early seral stages for summer range. Others need large areas of mature or old-growth forest for survival (e.g., owls, caribou), whereas some may only require certain old-growth habitat attributes such as snags. Hence, if these habitat features are maintained in managed forests, the impact of timber harvesting on wildlife diversity can be minimized.

This section is meant to provide forest field workers with a general understanding of the region's wildlife diversity and of important habitats that need special consideration in forest planning and management. The four main objectives of this section are:

- to introduce the concept of biological diversity (biodiversity) and some measures for its maintenance;
- to provide a working definition of wildlife, of threatened and endangered species, and of species that require management emphasis;
- to define important forested and non-forested wildlife habitats and to describe landscape and stand level habitat elements; and
- to provide information on seasonal occurrence and abundance of selected species in subzones and variants of the Nelson Forest Region.

6.2 Biological Diversity

The United States Office of Technology Assessment (OTA 1987) defined biodiversity as "the variety and variability among living organisms and the ecological complexes in which they occur". It is usually considered at three levels of biological organization: genetic, species, and ecosystem. The concept of genetic diversity implies a level of genetic variability within species that is required to ensure healthy populations and prevent extinction of species through human interference. Since it is difficult to manage hidden attributes, such as genes, a surrogate measure is the maintenance of healthy populations across their natural range. Managing a species across their natural range ensures maintenance of any genetic adaptations attributed to differing environmental factors. Species diversity refers to the variety of living organisms in a given area and can only be maintained if land management addresses the conservation needs of all species in that area. Ecosystem diversity relates to the diversity and health of ecological complexes in which species occur. Therefore, efforts to conserve species must include the establishment of a network of representative ecosystems (Fenger and Harcombe 1991).

Biodiversity, however, is not simply the number of genes, species, or ecosystems in a given area but a multitude of ecological phenomena. For example, species composition within a community, habitat structure and landscape patterns, and ecological and evolutionary processes such as gene flow, interspecific interactions, or landscape disturbances, are all important components that should be addressed in the management for biodiversity.

One aspect of biodiversity is the maintenance of wildlife populations. The first step in maintenance of biodiversity is recovery and conservation of threatened and endangered species. All the threatened and endangered species and the subzone or variants in which they occur in the Nelson Forest Region are included in Table 6.1. Maintenance of these species requires a thorough knowledge of their habitat requirements in areas considered for development. The second step in managing for maintenance of biological diversity is to ensure that the management of habitats and human activities does not continue to place native species within the regional ecosystems on threatened and endangered lists.

6.3 Wildlife Species

The term "wildlife" is used to describe all terrestrial vertebrate animals including amphibians, reptiles, birds, and mammals. Until recently, wildlife has often been equated with endangered or highly visible animals (e.g., grizzly bears) or species hunted by man (e.g., white-tailed deer). Now the importance and interdependency of all species in the ecosystem is recognized. Although all species in the ecosystem are components of biodiversity, some may be more important to managers than others because (i) they are rare or endangered, (ii) they may create habitat for others (e.g., primary cavity nesters excavate holes which are then used by secondary cavity nesters), (iii) they require specific habitats which are adversely affected by land use practices, or (iv) they are commercially valuable and hence a high population level is desired (Klenner 1991).

In the provincial wildlife strategy (B.C. Ministry of Environment 1991), all 630 wildlife species that occur in the province have been categorized into "Species at Risk" and "Species Not at Risk", based on six criteria: abundance, distribution, habitat integrity, population trend, reproductive potential, and national and international status.

Species at Risk are further subdivided into red- and blue-listed species.

Red List - This group consists of *endangered* or *threatened* species which are defined as those with low abundance. They are legally designated as either *threatened* or *endangered* -- or are being considered for such status --

because of the danger of extirpation[34] or extinction. *Endangered* species are any indigenous (native) species threatened with imminent extinction or extirpation throughout all or a significant portion of their range in B.C. *Threatened* species are any indigenous species that are likely to become endangered in B.C. if factors affecting their vulnerability are not reversed. There are eight (8) red-listed species in the Nelson Forest Region. Townsends big-eared bat may be the species most dependent on forest habitat for survival. The other red-listed species are birds, except for the Cascade mantled ground squirrel.

Blue List - This group consists of *sensitive* or *vulnerable* species which are any indigenous species that are not *threatened* but are particularly at risk. Population viability is a concern, as indicated by significant current or predicted downward trends in population numbers or density, and/or habitat suitability (which would further reduce existing distribution). Populations are included here that are generally suspected of being vulnerable, but for which information is too limited to allow designation in another category.

There are 3 amphibians, 3 reptiles, 7 mammals and 34 birds blue-listed in the Nelson Forest Region. The best known of these are the grizzly bear and the caribou but many others are forest dependent and many wildlife tree dependent.

Species Not at Risk are further subdivided into yellow- and green-listed species.

Yellow List - This group consists of *management emphasis* species that are managed to meet particular public demands. They include most game and furbearing species.

Green List - This group consists of *no management emphasis* species that do not receive special management efforts, due to low public demand or interest. They are managed only by the application of broad habitat management guidelines. Like all other species, their status will be periodically reviewed.

A list of wildlife species of the Nelson Forest Region and their provincial status is given in Table 6.1. Although not all species occurring in the region are included in this table, the totals indicate the great wildlife diversity of the region. For example, 333 wildlife species occur in the ICHdw and ICHxw subzones which represents 60% of all wildlife species of British Columbia (including marine mammals and birds). This diversity is primarily the result of the high habitat productivity and structural heterogeneity of these subzones.

6.4 Wildlife Habitat

As defined by the B.C. Wildlife Act (1982), habitat means "the air, soil, water, food, and cover components of the environment on which wildlife depend directly or indirectly in order to carry out their life processes."

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[34] Extirpation refers to extinction of local populations.

Wildlife habitat management, however, differs from forest stand management as habitat must be considered at various levels. Some wildlife species use a variety of habitats spread across the landscape while others only require small patches within the forest or certain forest attributes at various times of the year for denning, breeding, feeding, or shelter. When managing forest habitat for biodiversity, it is therefore important to maintain broad landscape features, such as a mosaic of forest stands, in a variety of age groups, including old growth within a watershed, and stand level attributes such as a source of snags for cavity dependent species.

6.4.1 Landscape level habitat

Fragmentation and Corridors

Landscapes are naturally fragmented. In the Nelson Forest Region, non-forested habitats such as avalanche tracks, lakes, subalpine grasslands and meadows, wetlands, and parklands create natural openings within the forested landscape. Forests bordering these habitats are important as they maintain the suitability of non-forested habitats for wildlife species. For example, deer and elk prefer to forage in meadows or wetlands that are in close proximity to the thermal and hiding cover provided by forests.

Timber harvesting changes the natural fragmentation patterns of a landscape and often reduces and isolates wildlife habitat into small patches. This can affect wildlife populations in a variety of ways. For some species habitat fragmentation results in increased predation and parasitism while others are subjected to harsher weather conditions or increased vulnerability to large-scale fires and disease epidemics. Small populations are also susceptible to demographic changes such as loss of reproductively active individuals and may experience loss of genetic variability through inbreeding (Wilcove 1987).

One way to minimize problems associated with habitat fragmentation is to link wildlife habitat patches by travel corridors. Such landscape linkages can function as pathways for genetic interchange, for daily or seasonal movements, and for range extension. When combined with buffer zones and old-growth and riparian habitat retention, corridors can ensure high quality wildlife habitat within managed forests.

Old-Growth Forest Ecosystems

Old-growth forests have a major ecological role in contributing to biodiversity and forest productivity. Many species have evolved that are either attribute dependent on or, to some extent, associated with these forests (see Table 6.1). On a landscape level, old-growth provides thermal and hiding cover for wildlife, intercepts snow in winter and thus increases access to food and travelling efficiency, and contains a structural diversity that enables species to co-exist in the same habitat.

Many of the old-growth habitat attributes that contribute to wildlife diversity are reflected in the following conceptual definition provided by the Old Growth Strategy Project (1992):

Old growth is a forest that contains live and dead trees of various sizes, species composition and age class structure that are part of a slowly changing but dynamic ecosystem. The age and structure of old growth varies significantly by forest type and from one biogeoclimatic zone to another. However, old growth is typically distinguished from younger stands by several of the following attributes:

- *large trees for species and site;*
- *wide variation in tree sizes and spacing;*
- *accumulations of large size dead standing and fallen trees;*
- *multiple canopy layers;*
- *canopy gaps and understory patchiness; and*
- *decadence in the form of broken or deformed tops or boles and root decay.*

Riparian Forest Habitats

Riparian zones are the land adjacent to the normal high water line in a stream, river, lake, or pond and extend to the portion of land which is influenced by the presence of adjacent water. These zones are extremely important for fish and wildlife. These habitats provide lush vegetation for forage and cover, horizontal and vertical diversity which provides abundant niches for wildlife, invertebrate populations important as forage for many bird and mammal species, a water source for drinking, and a more moderate and stable microclimate than the surrounding upland habitats (Doyle 1990). Streams and their riparian zones provide naturally diverse and highly productive corridors. Lower elevation floodplain sites are particularly productive and are losing diversity formerly provided by large cottonwood and spruce trees. Because of the high productivity and favorable conditions, many wildlife species reach their highest densities in riparian habitats, especially in those adjacent to old-growth forests.

Fish habitat is maintained by the presence of trees in riparian zones. Larger diameter riparian trees continue to play a role when they become instream woody debris. There they improve bank stability, reduce sediment transport, and provide cover and habitat diversity for fish.

6.4.2 Stand level habitat

Wildlife Trees

The term "wildlife tree" refers to "any tree which provides present or future critical habitat for maintenance or enhancement of wildlife". Significant value and uniqueness of a wildlife tree as critical wildlife habitat may be provided by one or more physical attributes such as structure, age, condition, species, geographic location or surrounding habitat features (Backhouse and Lousier 1991). The largest group of wildlife tree users are cavity-nesting birds such as owls, woodpeckers, and some ducks. Raptors such as Bald Eagles and Ospreys build their nest in dead or broken-top trees and use the branches of these trees for perching. Occupied bird nests are protected under the B.C. Wildlife Act (Section 35). Wildlife tree using mammals include martens which often raise their young in cavities, black bears which hibernate in hollow trees, and several bat species which roost in cavities or behind loose bark.

Most of the species described in Table 6.1 under the column headed "degree of old-growth need" are wildlife tree dependent species. The best types of trees to select are the larger trees and those with some decay, as these have a higher suitability for the largest number of species, over the longest period.

Coarse Woody Debris (CWD)

CWD includes sound and rotting logs and stumps that provide cover for small mammals and their predators. It is widely used by invertebrates which, in turn, are used as forage by insectivorous species (e.g., shrews). CWD provides nesting and denning sites for birds and larger mammals and is important in the courtship rituals of species such as grouse. It also provides a sheltered micro-environment for reptiles and amphibians that cannot tolerate hot and dry conditions. CWD is also used for access routes below snow which are particularly important for marten (Klenner 1991).

Deciduous Trees

Deciduous trees provide foraging and nesting habitat for songbirds such as warblers, vireos, and flycatchers and are used by migrating passerines as resting and foraging areas. Deciduous trees are often a minor component in a conifer forest and provide valuable habitat diversity. Many primary cavity-nesters use aspen and cottonwood; probably because cavity excavation is easier (Klenner 1991). Because of their large size and tendency to break off at the top, cottonwood trees are the preferred nest structure for the Ospreys of the Nelson Forest Region.

TABLE 6.1 Selected wildlife species by subzone and variant[a]

Species	Status[b]	Degree of old-growth need[c]	PP dh1	PP dh2	MS dm	MS dk	IDF xh	IDF dm1	IDF dm2	ICH dw, xw	ICH mk	ICH mw	ICH wk	ESSF dk, dc	ESSF wm, wc, vc
AMPHIBIANS															
Coeur d'Alene salamander	B									y[d]					
Ensatina salamander	G	a					y								
Tailed frog	B	a									y				
Tiger salamander	B						Y	Y							
REPTILES															
Gopher snake	B		Y				Y								
Night snake	B						y								
Western rattlesnake	B		Y				Y			y					
Painted turtle	Y		Y	Y			Y	Y	Y	Y	Y	Y	y		
MAMMALS															
Badger	B		y	y	y	y	Y	Y	Y	y	y	y	y	y	y
Big brown bat	G	a	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bighorn sheep	Y			pw	y	Psaw	PW	Y	Y	y	s			Y	s
Black bear	Y	a	y	y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bobcat	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Caribou	B	d				w						sW	Y	PsAW	Y
Cascade mantled ground squirrel	R	a			y		y	y						y	
Cougar	Y		y	y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Coyote	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Elk	Y		Y	Y	s	Y	y	Y	Y	Y	Y	Sy	y	PSAw	SA
Fisher	B	a			Y	Y	Y		Y		y	y	y	Y	Y

TABLE 6.1. (Continued)

Species	Status[b]	Degree of old-growth need[c]	PP dh1	PP dh2	MS dm	MS dk	IDF xh	IDF dm1	IDF dm2	ICH dw, xw	ICH mk	ICH mw	ICH wk	ESSF dk, dc	ESSF wm, wc, vc
MAMMALS															
Gray wolf	Y		y	y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Great Basin pocket mouse	B		Y												
Grizzly bear	B	a			y	PSAw	p	p	p	Psaw	y	y	Y	SAW	SAW
Long-legged myotis	G	a	S	S			S	S	S	S	S	S	S	S	S
Lynx	Y		y	y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Marten	Y	d	y	y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Moose	Y	a			Y	Y	PsAW		Y	y	Y	Y	y	pSAw	pSAw
Mountain goat	Y	a			y	PsAW	y		w			Y		Y	Y
Mule deer	Y	a	PsA W		PSAW	Y	Y	Y	Y	Y	S	Sw	S	SA	SA
Northern flying squirrel	G	a			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Northern long-eared myotis	B	a										s	s		S
Porcupine	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red-tailed chipmunk	B					Y				Y	y	Y			
River otter	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Silver-haired bat	Y	a	S	S	S	S	S	S	S	Y	Y	Y	Y	S	S
Southern red-backed vole	G	a			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Townsend's big-eared bat	R		S				S	S		y	y	y			
White-tailed deer	Y		Y	Y	PSA	Y	Y	Y	Y	Y	S	S	s	PSA	PSA
Wolverine	Y	a	y	y	y	y	Y	Y	Y	y	y	y	y	y	y

TABLE 6.1. (Continued)

Species	Status[b]	Degree of old-growth need[c]	PP dh1	PP dh2	MS dm	MS dk	IDF xh	IDF dm1	IDF dm2	ICH dw, xw	ICH mk	ICH mw	ICH wk	ESSF dk, dc	ESSF wm, wc, vc
BIRDS															
American Avocet	B		p			p		ps		p	p				
American White Pelican	R		sm				sM	sM		sm		sm			
Anna's Hummingbird	B						aw	sw		w		pw			
Arctic Tern	B						sa	a							
Bald Eagle	B	a	swM		ps	ps	swM	swM		swM	sM	swM	Psa	ps	ps
Barn Owl	Y						y	s				psw			
Barred Owl	G	a	pw				y	y		y	a	y	a		
Barrow's Goldeneye	Y	a	SwM		sm	sm	SwM	SwM		SwM	sm	y	y	sm	sm
Black-backed Woodpecker	G	a	y		y	y	y	y		y	y	y	y	y	y
Black-chinned Hummingbird	B						ps	ps		ps		ps			
Black-crowned Night Heron	B						sm			s	ps				
Blue Grouse	Y	a	y		y	y	y	y		y	y	y	y	y	y
Bobolink	B		ps			s	ps	ps		ps	ps	ps			
Boreal Owl	G	a			a	a				p		p		y	y
Brewer's Sparrow	B		ps				ps	ps		ps					
Brown Creeper	G	a	y		y	y	y	y		y	y	y	y	y	y
Bufflehead	Y	a	SwM		SwM	SwM	SwM	SwM		SwM	sm	SwM	ps	ps	ps
Burrowing Owl	R		wm				y	a							
California Gull	B		sa				Y	ps		sm	sm	PSaw	sa		
Canyon Wren	R		y				sm			y					

TABLE 6.1. (Continued)

Species / Status[b]		Degree of old-growth need[c]	PP dh1	PP dh2	MS dm	MS dk	IDF xh	IDF dm1	IDF dm2	ICH dw, xw	ICH mk	ICH mw	ICH wk	ESSF dk, dc	ESSF wm, wc, vc
BIRDS															
Caspian Tern	B						ps			ps					
Chestnut-backed Chickadee	G	a			y	y				Y	y	Y	Y		
Clark's Nutcracker	G	a	AW		psAW	psAW	sMW	sMW		psAW	psA W	psA W	y	y	y
Common Merganser	Y	a	SwM		sm	sm	SwM	SwM		PSaw	Sw M	SwM	sm	ps	ps
Common Poorwill	R		s				sm	s		ps					
Flammulated Owl	B	a	a		ps		s	sm						s	
Forster's Tern	R						sm			PSa					
Grasshopper Sparrow	B						sm	ps							
Gray Jay	G	a	w		y	y	y	y		y	y	y	y	y	y
Great Blue Heron	B	a	Y		s	s	Y	Y		SwM	sa	SwM	sa		
Great Gray Owl	G	a	y		s		y	y			w	w			
Green-backed Heron	B							s		p					
Gyrfalcon	B						wm	wm			a				
Hairy Woodpecker	G	a	y		y	y	y	y		y	y	y	y	ps	ps
Hermit Thrush	G	a	sm		sa	sa	sm	sm		sm	sm	sm	sm	s	s
Hooded Merganser	Y	a	SwM		sm	sm	SwM	SwM		PSaw	Sw M	SwM	sm	ps	ps
Hudsonian Godwit	B					s	a	p							
Least Sandpiper	B		sm		a	a	sm	sm		a	a	a	a	a	a
Le Conte's Sparrow	B							s							

TABLE 6.1. (Continued)

Species	Status^{b}	Degree of old-growth need^{c}	PP dh1	PP dh2	MS dm	MS dk	IDF xh	IDF dm1	IDF dm2	ICH dw, xw	ICH mk	ICH mw	ICH wk	ESSF dk, dc	ESSF wm, wc, vc
BIRDS															
Lesser Golden-plover	B		m				m	m		a		a			
Lewis' Woodpecker	B	a	sm				SwM	sm		sm	sm	sm	a		
Long-billed Curlew	B		ps				psa	ps		ps					
Merlin	G	a	y		sm	sm	y	y		y	y	y	sm	sm	sm
Northern Goshawk	G	a	y		y	y	y	y		y	y	y	y	y	y
Northern Shrike	B		mw		mw	mw	y	y		mw	mw	mw	mw	a	a
Olive-sided Flycatcher	G	a			ps	ps	sm	sm			ps	ps	ps	s	s
Osprey	Y	a	PSa		ps	ps	PSaw	PSa		SwM	ps	PSaw	sm		
Pacific Loon	B		swm		s		swm	swm		swm	sm	swm	sm	sm	sm
Peregrine Falcon	B		sm		m	sm	y	sm		sm	sm	sm	ps	ps	ps
Pileated Woodpecker	Y	a	y			y	y	y		y	y	y	y		ps
Prairie Falcon	R		m				y	sm		sw	y	s			
Pygmy Nuthatch	G	a	y				y	y							
Red-breasted Nuthatch	G	a	y		y	y	y	y		y	y	y	y	y	y
Red-breasted Sapsucker	G	a					s						ps		
Red Crossbill	G	a			Y	Y	Y	Y		Y	Y	Y	Y	y	y
Red-throated Loon	B						aw	a							
Ring-billed Gull	B		sm				Y	sm		swM	sm	sM	s		
Short-billed Dowitcher	B		p			ps	a	m		s		s			
Spruce Grouse	Y	a	y		y	y	y	y		y	y	y	y	y	y
Three-toed Woodpecker	G	a	y		y	y	y	y		y	y	y	y	y	y
Townsend's Warbler	G	a			sm	sm	sm	sm		sm	sm	sm	sm	sa	sa

TABLE 6.1. (Continued)

Species	Status^{b}	Degree of old-growth need^{c}	PP dh1	PP dh2	MS dm	MS dk	IDF xh	IDF dm1	IDF dm2	ICH dw, xw	ICH mk	ICH mw	ICH wk	ESSF dk, dc	ESSF wm, wc, vc
BIRDS															
Varied Thrush	G	a	w		sm	sm	y	y		psAW	smw	psA W	psA W	sm	sm
Vaux's Swift	B	a	PS				PSa	PSa		PSa	ps	PSa	s		
Western Bluebird	B		ms				sm			sm	sm	sm			
Western Flycatcher	G	a			sm	sm				sm	sm	sm	sm		
Western Grebe	B					m	SwM	sm		SwM	sm	sm	sm		
White-breasted Nuthatch	G	a	y				y	y		y	y	y	m		
White-headed Woodpecker	B	a					y	ps							
White-throated Swift	B		ps				ps			ps					
White-winged Crossbill	G	a			sm	sm	sm	sm		sm	sm	sm	sm	sa	sa
Williamson's Sapsucker	B	a	ps		sm		ps								
Wood Duck	Y	a	sm				w	ps		sm	ps	ps			
Yellow-breasted Chat	B									s					
Yellow-headed Blackbird	Y		PSaw		ps	ps	PSaw	PSaw		PSa	sm	PSa	ps		
TOTAL^{e} AMPHIBIANS			4		4	5	8	7		6	7	6	6	3	3
TOTAL REPTILES			6		0	0	10	3		7	6	6	4	0	0
TOTAL MAMMALS			51		54	57	62	63		58	57	63	57	57	56
TOTAL BIRDS			220		154	172	281	250		262	205	234	188	114	108

See footnotes next page

TABLE 6.1. (Concluded)

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[a] The following subzones and variants are grouped to match the level of information available for the species listed. IDFxh includes data from IDFxh, xw, and xm; IDFdm includes data from IDFdm and dk; ICHmk includes data from ICHmk and dk; ESSFdk and dc includes data from ESSFdk, dc, and dv; and ESSFwm, wc, vc includes data from ESSFwm, wc, vc, vv, wv, and wk. The IDFxw, xm, and dk, ICHdk, and ESSFdv, vv, wv, and wk are not found in the Nelson Forest Region.

[b] R=red; B=blue; Y=yellow; G=green.

[c] a=attribute dependent. Species requires old-growth forest attributes such as large dead trees or coarse woody debris (stand level).
d=forest dependent. Species requires intact old-growth forests (landscape level).

[d] Abundance is indicated by a lower or upper case letter. Common or abundant is an upper case letter. Uncommon, scarce, rare, or casual is a lower case letter. An upper case letter does not indicate abundance throughout a subzone variant, but nearly always refers to local abundance. However, if a species has a known abundance in only a small locality in a subzone or variant a lower case letter is used. Seasonality is indicated by a letter code.
P - spring (March-May); S - summer (June -August); A - autumn (September-November); W - winter (December-February); M - migratory (Spring and Autumn);
Y - yearlong. Some cases do not fit neatly into this scheme. For instance, a species which is known to be migratory, but has on occasion been seen in December in a particular subzone, would still be listed as M. All entries are based on the provincial wildlife data base prepared by Stevens (1992) for the Wildlife Interpretation Subgroup.

[e] Totals refer to the total number of species known to occur in each subzone.

7 FOREST HEALTH RISKS IN THE NELSON FOREST REGION

by

D.J. Norris and R.D. Stewart

7.1 Introduction

Diseases and insects strongly influence forest stand development and structure in the Nelson Forest Region. Root diseases, such as *Armillaria ostoyae*, are widespread in many ecosystems at various intensities, and have a high probability of being exacerbated as a result of certain cutting systems. For example, partial cutting has and will contribute greatly to the presence and severity of *Armillaria* root disease in stands where it is present. Diseases can influence a variety of hosts which include trees, shrubs, and an unknown number of herbs. The presence of disease can affect a range of resource values including timber, wildlife, recreation, and visual quality.

The role of insects in the ecosystem is important and may be increasing in the region due to fire exclusion. Current outbreaks of mountain pine beetle in the ICH have greatly influenced the successional development of large areas, as has the western spruce budworm in the multi-layered stands of the IDF.

Natural ecosystem complexity has created disease-insect relationships. A common example of this in the Nelson Forest Region is the interaction between the balsam bark beetle and *Armillaria* in the ESSF. Other site factors will also determine the intensity or presence of forest health agents. Regional examples include the interaction between fire and *Rhizina undulata* and/or black army cutworm, which are common in ICH subzones and ESSF subzones transitional to the ICH.

Through careful interpretation of an ecosystem and consideration of disease, insect and host relationships, the forest manager will have a better understanding of forest health risks and their implications on future resource values.

7.2 Common Forest Health Risks

Through careful interpretation of an ecosystem the forest manager can estimate the probability of a variety of forest health risks. These risks are portrayed on the following tables. Considering these risks at the PHSP stage will encourage better site productivity (and assist in the assessment of "reasonable pest risk").

Some forest health agents will be found on a wide variety of sites and species, and these are noted on the first table entitled "Broad Spectrum Agents" (Table 7.1). Other forest health agents have more specific probability patterns of incidence, severity and risk, and these are tabled by host tree species.

The forest health risk estimates are based on the general distribution of forest health agents on common site conditions and does not account for ecological extremes or management activities which may significantly alter site conditions.

The incidence and severity of a forest health agent is influenced by a number of natural and man-induced factors. To account for this variation, we have grouped risks in the following manner:

P - PROBABLE AND PERSISTENT INCIDENCE. Careful planning and management is necessary to reduce the impact of these pests.

C - CONDITIONAL OR CYCLIC INCIDENCE. Presence dependent on host availability, climate, stand structure, and other factors. Several conditions must occur simultaneously for significant impacts.

? - SPECULATIVE OR UNCOMMON INCIDENCE. Pest occurrence undocumented or importance not determined.

For specific information on forest health agents and their management, refer to the "Nelson Forest Region Preharvest Silviculture Prescription Standard Operating Procedures" or "Field Guide to Pests of Managed Forests in British Columbia", or contact the appropriate Forest Health Specialist.

TABLE 7.1 Common broad spectrum forest health agents in the Nelson Forest Region

Latin name	Fd	Bl	Bg	Py	Pl	Pw	Hw	Cw	Lw	Sx	At	Ep	Common name
Actebia fennica	P[a]	P	P	?	P	P	P	P	P	P	P	P	Black army cutworm
Rhizina undulata	P	P	P	P	P	P	P	P	P	P			*Rhizina*
Armillaria ostoyae	P	P	P	P	P	P	P	P	P	P	P	P	*Armillaria*
Phaeolius schweinitzii	P	P	P	P	P	P	P	P	P	P			Brown cubical butt rot
Mammals, various	P	P	C	C	P	P	P	P	P	P	C	C	

---

[a] P - Probable and persistent incidence. Careful planning and management is necessary to reduce the impact of these pests.
C - Conditional or cyclic incidence. Presence dependent on host availability, climate, stand structure, and other factors.
? - Speculative or uncommon incidence. Pest occurrence undocumented or importance not determined.

TABLE 7.2 Common forest health agents for **western redcedar** (Cw) in the Nelson Forest Region

Latin name	ESSF	ICH								Common name
	wcl	xw	dw	mk1	mw1	mw2	mw3	wk1	vk1	
Lambdina fiscellaria								C[a]	C	Western hemlock looper
Heterobasidion annosum								?	?	Annosus root disease
Phellinus weirii[b]		P	P	P	P	P	P	P	P	Laminated root rot
Inonotus tomentosus	?	?	?	?	?	?	?	?	?	Tomentosus root rot

---

[a] P- Probable and persistent incidence. Careful planning and management is necessary to reduce the impact of these pests.
C - Conditional or cyclic incidence. Presence dependent on host availability, climate, stand structure, and other factors.
? - Speculative or uncommon incidence. Pest occurrence undocumented or importance not determined.

[b] cedar variety only

TABLE 7.3 Common forest health agents for **western larch (Lw)** in the Nelson Forest Region

Latin name	ESSF	ICH							IDF			MS		PP		Common name
	wc1	xw	dw	mk1	mw1	mw2	mw3	wk1	vk1	xh1	dm1	dm2	dm1	dk	dh1	dh2	
Coleophora laricella				?[a]									?				Larch case bearer
Prisitiphora erishsonii			C	C		?	C				C	C		P			Larch sawfly
Arceuthobium laricis	C		P	P	C	P	P			C	P	P	P	P	?	P	Larch dwarf mistletoe

---

[a] P- Probable and persistent incidence. Careful planning and management is necessary to reduce the impact of these pests.
C - Conditional or cyclic incidence. Presence dependent on host availability, climate, stand structure, and other factors.
? - Speculative or uncommon incidence. Pest occurrence undocumented or importance not determined.

TABLE 7.4 Common forest health agents for **grand fir (Bg)** in the Nelson Forest Region

Latin name	ICH		Common name
	xw	dw	
Acolytus ventralis		C[a]	Fir engraver beetle
Phellinus weirii	?	?	Laminated root rot

---

[a] P - Probable and persistent incidence. Careful planning and management is necessary to reduce the impact of these pests.
C - Conditional or cyclic incidence. Presence dependent on host availability, climate, stand structure, and other factors.
? - Speculative or uncommon incidence. Pest occurrence undocumented or importance not determined.

TABLE 7.5 Common forest health agents for **western white pine (Pw)** in the Nelson Forest Region

Latin name	ICH								Common name
	xw	dw	mk 1	mw 1	mw 2	mw 3	wk 1	vk1	
Dendroctonus ponderosae		C[a]			C			C	Mountain pine beetle
Cronartium ribicola[b]	?	P	P	P	P	P	P	P	White pine blister rust
Atropellis pinicola	?	C	?	?	C	?	?	C	Atropellis canker
Leptigraphium wageneri	?	C	?	?	P	P	C	C	

---

[a] P - Probable and persistent incidence. Careful planning and management is necessary to reduce the impact of these pests.
C - Conditional or cyclic incidence. Presence dependent on host availability, climate, stand structure, and other factors.
? - Speculative or uncommon incidence. Pest occurrence undocumented or importance not determined.

[b] Wherever Pw grows, white pine blister rust is a threat.

TABLE 7.6 Common forest health agents for ponderosa pine (Py) in the Nelson Forest Region

Latin name	ICH				IDF				PP		Common name
	xw	dw	mk1	mw2	xh1	un	dm1	dm2	dh1	dh2	
Dendroctonus ponderosae	C[a]	?	?		C	C	C	?	?	C	Mountain pine beetle
Dendroctonus brevicomis	?				C	?	?	?	C	C	Western pine beetle
Dendroctonus valens					?				?	?	Turpentine beetle
Arceuthobium americanum	C	?	C	C	C	C	C	C	C	C	Dwarf mistletoe
Phellinus weirii	C		C	P							Laminated root disease
Elytroderma deformans	P	?	P	P	P	P	P	P	P	P	Needle cast fungi

---

[a] P - Probable and persistent incidence. Careful planning and management is necessary to reduce the impact of these pests.
C - Conditional or cyclic incidence. Presence dependent on host availability, climate, stand structure, and other factors.
? - Speculative or uncommon incidence. Pest occurrence undocumented or importance not determined.

TABLE 7.7 Common forest health agents for **spruce (Sxw, Se)** in the Nelson Forest Region

Latin name	ESSF						ICH								IDF		MS		Common name
	dc1	dk	wm	wc1	wc4	vc	xw	dw	mk1	mw1	mw2	mw3	wk1	vk1	dm1	dm2	dm1	dk	
Dendroctonus rufipennis	C[a]	P	P	P	P	P		C	C	P	P	P	P	P	O	O	P	P	Spruce bark beetle
Pissodes strobi	C	P	P	P	C	P		P	P	P	P	P	P	P	C	C	P	P	Spruce leader weevil[b]
Adelges cooleyi[c]							C	C	C	C	C	C	C	C	C	C	C	C	Cooley spruce gall adelgid
Phellinus weirii											P	P							Laminated root rot
Inonotus tomentosus	P	P	P	P	P	P		P	P	P	P	P	P	P			P	P	Tomentosus root rot

---

[a] P - Probable and persistent incidence. Careful planning and management is necessary to reduce the impact of these pests.
C - Conditional or cyclic incidence. Presence dependent on host availability, climate, stand structure, and other factors.
? - Speculative or uncommon incidence. Pest occurrence undocumented or importance not determined.

[b] Also known as white pine weevil.

[c] Only with Douglas-fir/spruce mixes (not necessarily at the ecosystem stand level - same valley/landscape unit).

TABLE 7.8 Common forest health agents for **lodgepole pine (Pl)** in the Nelson Forest Region

Latin name	ESSF					ICH						IDF			MS		Common name
	dc1	dk	wm	wc1	wc4	xw	dw	mk1	mw1	mw2	mw3	un	dm1	dm2	dm1	dk	
Dendroctonus ponderosae	C[a]	C	C	C		?	C	C	C	C	C		C		C	C	Mountain pine beetle
Pissodes terminalis			?	?				?			?		P	P			Lodgepole pine terminal weevil
Arceuthobium laricis						C	C	C	C	C	C	C	C	C	C	C	Larch dwarf mistletoe
Hylobius warreni	?	?	?		?		?	?	?	?			?	?	C	C	Warren's root collar weevil
Arceuthobium americanum	C	C	C	C		P	P	P	P	P	P		P	P	P	P	Lodgepole pine dwarf mistletoe
Phellinus weirii						C	C	C	C	C	C		C	C			Laminated root rot
Inonotus tomentosus	C	C	C	C		C	C	C	C	C	C	C	C	C	C	C	Tomentosus root rot

TABLE 7.8 (Continued)

Latin name	ESSF					ICH						IDF			MS		Common name
	dc1	dk	wm	wc1	wc4	xw	dw	mk1	mw1	mw2	mw3	un	dm1	dm2	dm1	dk	
Leptographium wageneri[b]	C[a]	C	C	C		P	P	P	P	P	P	P	P	P	P	P	Black stain root disease
Endocronartium harknessii	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P	Western gall rust
Atropellis piniphila	?		?	?	?	C	C	C	C	C	P	C	P	P	C	C	Atropellis canker
Cronartium spp.[c]	C		C	C	C	P	P	P	P	P	P	C	P	P	P	P	Blister rust

---

[a] P- Probable and persistent incidence. Careful planning and management is necessary to reduce the impact of these pests.
C - Conditional or cyclic incidence. Presence dependent on host availability, climate, stand structure, and other factors.
? - Speculative or uncommon incidence. Pest occurrence undocumented or importance not determined.

[b] Range constantly being expanded; believed to occur wherever Pl occurs.

[c] Provenance, alternate host distribution, and climate determine infection.

TABLE 7.9 Common forest health agents for **western hemlock (Hw)** in the Nelson Forest Region

Latin name	ICH								Common name
	xw	dw	mk1	mw1	mw2	mw3	wk1	vk1	
Acleris gloverana					?[a]	C	?		Western blackheaded budworm
Neodiprion tsugae		C		C	C	C			Hemlock sawfly
Lambdina fiscellaria lugubrosa							P		Western hemlock looper
Heterobasidion annosum							C	C	Annosus root disease
Echinodontium tinctorium	?	P	P	P	P	P	P	P	Indian paint fungus
Phellinus weirii						P	P	P	Laminated root rot
Inonotus tomentosus	?	?	?	?	?	?	?	?	Tomentosus root rot

---

[a] P - Probable and persistent incidence. Careful planning and management is necessary to reduce the impact of these pests.
C - Conditional or cyclic incidence. Presence dependent on host availability, climate, stand structure, and other factors.
? - Speculative or uncommon incidence. Pest occurrence undocumented or importance not determined.

TABLE 7.10 Common forest health agents for **Douglas-fir (Fd)** in the Nelson Forest Region

Latin name	ICH								IDF				MS		PP		Common name
	xw	dw	mk1	mw1	mw2	mw3	wk1	vk1	xh1	un	dm1	dm2	dm1	dk	dh1	dh2	
Dendroctonus pseudotsugae	P[a]	P	P	P	P	P	?	?	P	P	P	P	C	?	P	P	Douglas-fir beetle
Choristoneura spp.			C	C						P	P				P		Spruce budworm
Orgyia pseudotsugata									P		C				C		Douglas-fir tussock moth
Arceuthobium douglasii	P										P				?		Douglas-fir dwarf mistletoe
Adelges cooleyi[b]	C	C	C	C	C	C	C	C		C	C	C	C	C			Cooley spruce gall adelgid
Leptographium wageneri[c]	P	P	P	P	P	P	P	P	P	P	P	P	C	C	C	C	Black stain root disease
Phellinus weirii	C	?	C	P	P	P	?	?	?	?	?	?			?	?	Laminated root rot
Inonotus tomentosus[d]	?	?	C	C	C	?	?	?	?	?	?	?					Tomentosus root disease

---

[a] P- Probable and persistent incidence. Careful planning and management is necessary to reduce the impact of these pests.
C - Conditional or cyclic incidence. Presence dependent on host availability, climate, stand structure, and other factors.
? - Speculative or uncommon incidence. Pest occurrence undocumented or importance not determined.

[b] only with Douglas-fir - spruce mixes.

APPENDIX 1.

Nelson Forest Region stocking standards guidelines (1990)[1]

by

B. E. Peschke

Purpose

To provide guidelines for Basic Silviculture Stocking Standards on a biogeoclimatic subzone basis as a framework for setting targets and standards for the restocking of Crown land. Specifically, these guidelines will be used to:

- set targets and standards at the Preharvest Silviculture Prescription (PHSP) stage;
- to determine whether an area is satisfactorily restocked; and
- to determine free-growing status.

Authority

The Forest Act requires that basic silviculture be carried out by licensees on major tenures and the Forest Service on areas that yield Small Business revenue. The measures which either the licensee or the Forest Service plan to undertake to fulfil this obligation must be stated in an approved PHSP prior to harvest. The mandatory content of the PHSP, including stocking standards, is included in the Silviculture Regulations [Section 2(2)(j)]. These guidelines are provided as a benchmark against which proposed PHSPs can be assessed by the District Manager prior to approval. The guidelines replace those published in "A Field Guide for Identification and Interpretation of Ecosystems in the Nelson Forest Region (1986)" and the 1986 standard operating procedure.

Tree Farm Licence (TFL) holders may submit their own stocking standard proposals for approval by the Chief Forester as part of their Management and Working Plan (MWP). Timber Supply Area (TSA) committees may also submit stocking standard proposals to the Regional Manager for approval as part of the TSA plans. TFL or TSA guidelines should reflect local management objectives which differ from those used in deriving regional guidelines.

Background

The guidelines are based on mensuration data collected during the ecological classification process and through consultation with TSA steering committees, district staff, regional silviculture and research specialists, and Silviculture Branch. They represent our best estimate of the most suitable regimes and standards for the timber production objectives of the Crown in this region. Some of the primary objectives are to:

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[1] A provincially correlated revision of the tree species selection guidelines will be available in fall 1992.

- regenerate the most productive, ecologically adapted commercial species;
- set "middle-of-the-road" stocking levels with the implied objective of optimizing merchantable sawlog volume and future product options.

Definitions

Stocking method is the optimum regeneration method for the area upon which plans should be based — either natural or artificial. Natural regeneration is proposed on low-productivity sites, lodgepole pine sites, low-brush potential and/or sites with windfirm preferred species for a seed source. Planting is proposed on the high-productivity and/or high-brush potential sites.

Preferred species are the most desirable species to be regenerated due to their high productivity and/or value. These species should be targeted for the new crop and achieved via the appropriate silvicultural system, site preparation treatment, stocking method, and subsequent treatments.

Acceptable species are less desirable than the preferred species due to lower productivity and/or value but can be considered as a component of the new crop.

Minimum stocking standard (M.S.S.) is the minimum number of well-spaced, acceptable trees per hectare that must be growing on a site, as determined by standard Ministry procedures (regeneration survey), to consider an area satisfactorily restocked. This standard must be met within the specified regeneration delay period as well as at the time of the free-growing assessment.

Target-leader growth is the average annual leader growth as determined from the last three years of growth for nodal species or the last full-year's growth for non-nodal species, to be achieved at the time of the free-growing assessment. Targets are provided for both preferred and acceptable species.

Maximum density is the maximum number of trees per hectare to be growing on a site at the time of the free-growing assessment. The Provincial standard is 5000 trees per hectare for lodgepole pine and dry belt Douglas-fir stands.

Minimum inter-tree spacing is the minimum allowable horizontal distance between well-spaced trees. In most cases this will be two metres although with justification the minimum inter-tree spacing can be reduced to 1.7 metres.

The following definitions are contained within the Forest Amendment Act (No. 2), 1987:

- **basic silviculture; and**
- **free-growing crop.**

The following definitions are contained within the Silviculture Regulation (B.C. Reg. 147/88):

- **regeneration delay; and**
- **target number.**

Acceptable advance regeneration

Criteria for cedar and hemlock will be developed pending the results of current Forest Resource Development Agreement (FRDA) research. Criteria for acceptable subalpine fir advance regeneration are as follows (based on work by Herring, Ivanco, Monchak, and others):

- only in those ecosystem associations where it is listed as a preferred or acceptable species;
- only trees that were less than 1.3 metres at the time of harvest;
- free from open wounds, damaged tops, forks, crooks, multiple tops, or sweep; and
- minimum 15 cm leader growth.

Stands of subalpine fir advance regeneration cannot be declared free-growing immediately after harvest but must undergo a minimum/maximum free-growing delay period of six to ten years to exhibit acceptable release from suppression.

Acceptability of white pine

Restrictions on white pine stocking are based on risk of losses due to blister rust and are as follows:

- natural regeneration—acceptable up to a maximum of 20 percent stocking per plot;
- artificial regeneration—acceptable up to a maximum of 50 percent stocking per plot if rust-resistant planting stock used; and
- if accepted as stocking, white pine must be pruned to inhibit rust infection. The latest free-growing date is extended to 20 years to allow pruning to three metres.

Acceptability of deciduous species

An increase in utilization of deciduous species has occurred in recent years and is expected to increase in the future. While our knowledge of "hardwood" culture is limited, it is reasonable to establish research plantations and naturally regenerated areas to improve our knowledge. PHSP proposals for cottonwood on alluvial flats and flood plains, and aspen and birch on upland sites must be accompanied by an SX trial proposal to be approved by the regional manager.

Free-growing criteria

In addition to the free-growing criteria and assessment procedures detailed in the Silviculture Manual, the following shall apply:

- free-growing trees must be 50 percent taller than the height of competing brush or other competing vegetation in the ICH and 25 percent taller in all other zones. This is the "size" standard as specified in the Silviculture Reg. 2.(2)(j).
- the definition of competing brush or other competing vegetation within the one meter radius cylinder does not include other acceptable crop species;
- free-growing trees must achieve a minimum leader growth of 15 cm per year to be considered "healthy";
- for all zones except the ESSF, regeneration must be established

on-site a minimum of five years before a free-growing assessment to demonstrate survival and growth. Regeneration in the ESSF must be established eight years; and

- a free-growing assessment shall be conducted no earlier than two complete growing seasons following a brushing treatment to demonstrate efficacy of the treatment.

PPdh1

Species Selection Guidelines and Stocking Standards

Site series	Species		M.S.S.	Regen delay	Free growing assessment		Target stocking	Leader Growth	
	Preferred	Acceptable			Early	Late		Pref.	Acc.
02[a]	non-forested								
03	very open or non-forested								
01[a]	Py	Fd	400	7	12	15	600	15	15
04[a]	Py	Fd	400	7	12	15	600	15	15
05[a]	Py,Lw	Fd	400	7	12	15	600	15	15
06[a]	Fd,Sxw		400	7	12	15	600		15

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[a] Based on less than ten plots.

PPdh2

Species Selection Guidelines and Stocking Standards

Site series	Species		M.S.S.	Regen delay	Free growing assessment		Target stocking	Leader growth	
	Preferred	Acceptable			Early	Late		Pref.	Acc.
02a[a]	non-forested								
02b	non-forested or very open								
01	Py,Fd	Lw[b],Pl[c]	400	7	12	15	600	15	15
03[a]	Py,Sw	Fd,Pl[c]	500	7	12	15	1000	15	15
04[a]	Py,Sw	Fd,Pl	500	7	12	15	1000	15	15

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[a] Based on less than ten plots.

[b] Lw rare in this variant.

[c] Not sampled but should display acceptable productivity.

IDFxh1

Species Selection Guidelines and Stocking Standards

Site series	Species		M.S.S.	Regen delay	Free growing assessment		Target stocking	Leader growth	
	Preferred	Acceptable			Early	Late		Pref.	Acc.
02	Py	Fd	200	7	12	15	400	15	15
03	Py	Fd	200	7	12	15	400	15	15
04	Py	Fd	400	7	12	15	600	20	20
05	Py	Fd	400	7	12	15	600	20	20
01	Fd,Py		500	7	12	15	1000	20	20
06	Fd,Py		500	7	12	15	1000	20	20
07	Fd,Py		500	7	12	15	1000	20	20
08	Fd	Pl,Lw[a],Py	700	4	9	15	1200	20	20
09	non-forested	wetlands							

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[a] Higher elvations within subzone; north aspects.

IDFdm1

Species Selection Guidelines and Stocking Standards

Site series	Species		M.S.S.	Regen Delay	Free growing assessment		Target stocking	Leader growth	
	Preferred	Acceptable			Early	Late		Pref.	Acc.
02	non-forested								
03[a]	Py	Fd	400	7	12	15	600	15	
01	Py,Lw,Fd	Pl	500	7	12	15	1000	15	15
04	Py,Fd,Lw	Pl	500	7	12	15	1000	15	15
05	Py	Lw,Sxw,Fd,Pl	700	7	12	15	1200	15	15
06[a]	Sxw,Fd,Lw	Pl	700	4	9	15	1200	15	
07[a]	Sxw		500	4	9	15	1000	15	15

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[a] Based on less than 10 plots.

IDFdm2

Species Selection Guidelines and Stocking Standards

Site series	Species		M.S.S.	Regen delay	Free growing assessment		Target stocking	Leader growth	
	Preferred	Acceptable			Early	Late		Pref.	Acc.
02[a]	non-forested								
03	Fd,Lw,Py,Pl		400	7	12	15	600	15	
01	Fd,Lw,Py,Pl		500	7	12	15	1000	15	
04	Lw,Sxw,Fd	Py,Pl	700	7	12	15	1200	15	15
05[a]	Sxw,Lw	Pl,Fd	500	7	12	15	1000	15	15
06[a]	Sxw,Lw	Pl,Fd	500	4	9	15	1000	15	15
07[a]	non-forested								

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[a] Based on less than ten plots.

MSdk

Species Selection Guidelines and Stocking Standards

Site series	Species		M.S.S.	Regen delay	Free growing assessement		Target stocking	Leader Growth	
	Preferred	Acceptable			Early	Late		Pref.	Acc.
02[a]	non-forested								
03[a]	Fd,Lw	Sxw,Pl	500	7	12	15	1000	15	15
04	Lw,Fd,Pl	Sxw	700	7	12	15	1200	15	15
01	Lw,Fd,Sxw,Pl	Bl	700	7	12	15	1200	15	15
05	Lw,Fd,Pl,Sxw	Bl	700	7	12	15	1200	15	15
06	Lw,Sxw,Fd	Pl,Bl	700	4	9	15	1200	15	15
07[a]	non-forested								

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[a] Based on data from less than ten plots.

MSdm1

Species Selection Guidelines and Stocking Standards

Site series	Species		M.S.S.	Regen Delay	Free growing assessment		Target stocking	Leader growth	
	Preferred	Acceptable			Early	Late		Pref.	Acc.
02	Fd,Lw[a],Pl		500	7	12	15	1000	25	
03[b]	Lw[a]	Fd,Bl,Pl	500	7	12	15	1000	25	15, Pl-20
04	Lw[a],Fd	Sxw,Pl	700	7	12	15	1200	25, Sxw-15	15
01	Lw,Fd	Pl,Sxw	700	7	12	15	1200	25	20, Sxw, Bl-15
05	Lw,Sxw,Pl,Fd	Bl	700	4	9	15	1200	25, Sxw-15	15
06	Fd,Sxw,Pl,Lw	Bl	700	4	9	15	1200	25, Sxw,Bl-15	15
07[b]	Fd,Sxw	Lw,Pl,Bl,Cw	700	4	9	15	1200	25, Sxw-15	15, Pl-20
08	Sxw	Pl,Bl	500	4	9	15	1000	15	15
09[b]	non-forested	wetlands							

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[a] Lw not sampled in this site series but may do well here.

[b] Based on less than 10 plots.

ESSFdc1

Species Selection Guidelines and Stocking Standards

Site series	Species		M.S.S.	Regen delay	Free growing assessment		Target stocking	Leader growth	
	Preferred	Acceptable			Early	Late		Pref.	Acc.
02[a]	Pl,Se,Bl		500	7	15	20	1000	15	
03	Pl,Se	Bl	500	7	15	20	1000	15	15
01	Se,Pl	Bl	700	4	12	20	1200	15	15
04	Pl,Se	Bl	700	4	12	20	1200	15	15
05	Pl,Se	Bl	500	7	15	20	1000	15	15
06[a]	Pl,Se	Bl	500	4	12	20	1000	15	15
07	non-forested								

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[a] Based on data from less than ten plots.

ESSFdk

Species Selection Guidelines and Stocking Standards

Site series	Species		M.S.S.	Regen delay	Free growing assessment		Target stocking	Leader growth	
	Preferred	Acceptable			Early	Late		Pref.	Acc.
02[a]	Fd[b],Pl	Se	500	7	15	20	1000	15	
03	Fd[b],Pl,Se	Bl	700	7	15	20	1200	15	15
04	Pl,Se,Fd[b, c], Pa	Bl	700	7	15	20	1200	15	15
01[a]	Pl,Fd[b],Se,Bl		700	7	15	20	1200	15	
05[a]	Pl,Se	Bl	700	4	12	20	1200	15	15
06[a]	Se,Pl	Bl	700	4	12	20	1200	15	15
07[a]	non-forested								

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[a] Based on data from less than ten plots.

[b] Fd should be planted below 1800 m in this subzone.

[c] Fd not sampled in this site series; however, it will likely do well.

ICHdw

Species Selection Guidelines and Stocking Standards

Site series	Species		M.S.S.	Regen delay	Free growing assessment		Target stocking	Leader growth	
	Preferred	Acceptable			Early	Late		Pref.	Acc.
02[a]	Fd,Pl,Py	Lw	500	7	12	15	1000	25	20
01a	Lw,Py,Fd	Pw[b],Hw,Pl, Cw	700	7	12	15(20)[c]	1200	25	20 Cw,Hw-15
01b	Lw,Py	Fd,Sxw,Pl, Bg,Cw,Pw[b]	700	7	12	15(20)[c]	1200	25	20 Cw,Sxw-15
03[a]	Fd,Sxw,Lw	Hw,Cw,Bg	700	4	9	15	1200	25 Sxw-15	15 Bg-20
04[a]	Cw,Sxw	Hw	700	4	9	15	1200	Cw-20 Sxw-15	15

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[a] Based on data from less than ten plots.

[b] Pw accepted only if there is no other preferred or acceptable species on the growing spot and only if Pw is free of any indication of white pine blister rust. Maximum 20 percent stocking for natural regen and 50 percent for "rust-resistant" planted stock.

[c] Extended window for pathological pruning of Pw.

ICHmk1

Species Selection Guidelines and Stocking Standards

Site series	Species		M.S.S.	Regen delay	Free growing assessment		Target stocking	Leader growth	
	Preferred	Acceptable			Early	Late		Pref.	Acc.
02[a]	Fd	Pl	400	7	12	15	600	25	
03	Lw,Pl,Fd		500	7	12	15	1000	25	
04[a]	Lw,Py,Fd,Pl,Sxw	Bl	700	7	12	15	1200	25, Sxw-15	15
01	Lw	Bl,Pl,Fd,Sxw	700	7	12	15	1200	25	20 Sxw, Bl-15
05	Lw,Fd,Pl,Sxw	Bl,Cw	700	4	9	15	1200	25, Sxw-15	15
06	Fw,Fd,Pl,Sxw	Bl,Cw	700	4	9	15	1200	25, Sxw-15	15
07[a]	Lw,Fd,Sxw	Bl,Cw,Pl	500	4	9	15	1000	25, Sxw-15	15
08[a]	non-forested								

---

[a] Based on data from less than ten plots.

ICHmw1

Species Selection Guidelines and Stocking Standards

Site series	Species		MSS	Regen delay	Free growing assessment		Target stocking	Leader growth	
	Preferred	Acceptable			Early	Late		Pref.	Acc.
02[a]	Lw[b],Pl,Fd	Sxw	700	7	12	15	1200	25	10
03[a]	Fd,Lw[b],Sxw	Pw[c],Pl	700	7	12	15(20)	1200	25, Sxw-15	20
04[a]	Lw[b],Fd,Sxw	Bl,Hw,Cw,Pw[c]	700	7	12	15(20)[d]	1200	25, Sxw-15	15 Pw-20
01	Lw[b],Fd,Pl	Sxw,Bl,Hw,Pw[c],Cw	700	4	9	15(20)[d]	1200	25, Sxw-15	15 Pw-20
05[a]	Lw[b,e],Sxw	Bl,Cw,Hw,Fd	700	4	9	15	1200	Lw-25 Sxw-15	15
06[e]	Sxw	Bl,Pl,Cw,Hw	700	4	9	15	1200	15	15
07[e]	Sxw	Bl,Pl,Cw,Hw	700	4	9	15	1200	15	15

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[a] Based on data from less than ten plots.

[b] Lw absent in northern portion of this variant.

[c] Pw accepted only if no other preferred or acceptable species on the growing spot and only if Pw is free of any signs of white pine blister rust. Maximum 20 percent stocking per plot for natural regen and 50 percent for "rust-resistant" planted stock.

[d] Extended window for pathological pruning of Pw.

[e] May require raised microsites.

ICHmw2

Species Selection Guidelines and Stocking Standards

Site series	Species		M.S.S.	Regen delay	Free growing assessment		Target stocking	Leader growth	
	Preferred	Acceptable			Early	Late		Pref.	Acc.
02[a]	non-forested								
03	Lw,Fd,Sxw	Pw[b],Pl	500	7	12	15(20)[c]	1000	30	20
04	Lw,Fd,Sxw	Pw[b],Pl	700	7	12	15(20)[c]	1200	30	20
01	Lw,Fd,Pl	Pw[b],Sxw,Cw,Bl,Hw	700	7	12	15(20)[c]	1200	35	15, Pw-20
05	Lw,Fd,Sxw	Bl,Hw,Pw[b],Cw	700	4	9	15(20)[c]	1200	35	15, Pw-20
06	Lw,Sxw,Fd	Bl,Pw[b],Hw,Cw	700	4	9	15(20)[c]	1200	25	15, Pw-20
07[a]	Lw,Sxw	Bl,Hw,Cw	500	4	9	15	1000	15	15
08[a]	Sxw	Bl,Hw,Cw	500	4	9	15	1000	15	15
09[a]	non-forested								

---

[a] Based on less than 10 plots.

[b] Pw accepted only if no other preferred or acceptable species on the growing spot and only if Pw is free of any signs of white pine blister rust. Maximum 20 percent stocking per plot for natural regen and 50 percent for "rust-resistant" planted stock.

[c] Extended window for pathological pruning of Pw.

ICHmw3

Species Selection Guidelines and Stocking Standards

Site series	Species		M.S.S.	Regen delay	Free growing assessment		Target stocking	Leader growth	
	Preferred	Acceptable			Early	Late		Pref.	Acc.
02	Pl,Fd		500	7	12	15	1000	20	20
03	Pl,Fd[a]	Lw[b]	500	7	12	15	1000	25	25
04	Fd[a],Pl	Lw[b],Pw[c],Sxw[d]	700	7	12	15(20)[e]	1200	30	30
05	Fd[a],Pl	Lw[b],Pw[c],Sxw[d]	700	7	12	15(20)[e]	1200	30	30
01	Fd[a],Pl,Sxw[d]	Lw[b],Pw[c],Bl[f],Hw	700	4	9	15(20)[e]	1200	35	35
01-YC	Fd[a],Pl,Sxw[d]	Lw[b],Pw[c],Bl[f],Hw	700	4	9	15(20)[e]	1200	35	35
06	Sxw,Fd[a],Cw,Hw	Pw[c],Lw[b],Bl[f],Pl	700	4	9	15(20)[e]	1200	35	35
07	Sxw,Fd[a],Cw	Lw[b],Bl[f],Hw,Pw[c]	700	4	9	15(20)[e]	1200	35	35
08	Sxw,Cw	Bl[f],Pl,Hw,Pw[c]	500	4	9	15(20)[e]	1000	30	30
09	non-forested	wetlands							

See next page for footnotes.

ICHmw3
(continued)

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[a] On south aspects below 1200 m. Not on areas subject to flooding, high water table, or cold air drainage, or on steep north aspects.

[b] Outside of natural range, therefore continue small planting trials.

[c] Pw accepted only if no other preferred or acceptable species on growing spot and only if no indication of white pine blister rust. Maximum 20 percent stocking per plot for natural regen and 50 percent for "rust-resistant" planting stock.

[d] Elevations above 1000 m.

[e] Extended window for pathological pruning of Pw.

[f] Elevations above 1200 m.

ESSFwc1

Species Selection Guidelines and Stocking Standards

Site series	Species		M.S.S.	Regen delay	Free growing assessment		Target stocking	Leader growth	
	Preferred	Acceptable			Early	Late		Pref.	Acc.
02[a]	Se,Pl,	Bl[b]	500	7	15	20	1000	15, Pl-25	15
01[a]	Se,Pl, Bl[b]		700	4	12	20	1200	15, Pl-25	
03[a]	Se,Pl, Bl		700	4	12	20	1200	15, Pl-25	
04[a]	Se,Pl, Bl		700	7	15	20	1200	15, Pl-25	
06[a]	non-forested								

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[a] Based on less than 10 plots.

[b] Fd, Lw, Pw show good growth, but occur rarely; correct provenance is essential.

ESSFwc2

Species Selection Guidelines and Stocking Standards

Site series	Species		M.S.S.	Regen delay	Free growing assessment		Target stocking	Leader growth	
	Preferred	Acceptable			Early	Late		Pref.	Acc.
02	Pl	Se	500	7	15	20	1000	15, Pl-25	15
03	Pl,Se	Bl	500	7	15	20	1000	15, Pl-25	15
04	Se	Pl,Bl	700	7	15	20	1200	15	15, Pl-25
05	Se	Pl,Bl	700	7	15	20	1200	15	15, Pl-25
01	Se	Pl,Bl	700	4	12	20	1200	15	15, Pl-25
06	Se	Bl	700	4	12	20	1200	20	15
07	Se	Bl	700	4	12	20	1200	20	15
08	Se,Pl	Bl	500	4	12	20	1000	20	15
09	Pl	Se,Bl	200	4	12	20	400	20	15
10	non-forested								

ESSFwc4

Species Selection Guidelines and Stocking Standards

Site series	Species		M.S.S.	Regen delay	Free growing assessment		Target stocking	Leader growth	
	Preferred	Acceptable			Early	Late		Pref.	Acc.
02[a]	Pl,Se	Bl,Pa	500	7	15	20	1000	Pl-25, Se-15	15
03[a]	Pl,Se	Bl	500	7	15	20	1000	Se-15, Pl-25	15
04[a]	Se,Pl,Bl		700	7	15	20	1200	15, Pl-25	
01	Se,Pl,Bl		700	4	12	20	1200	15, Pl-25	
05[a]	Se,Pl,Bl		700	4	12	20	1200	15, Pl-25	
06[a]	Se,Pl,Bl		700	4	12	20	1200	15, Pl-25	
07[a]	Se,Pl,Bl		500	4	12	20	1000	15, Pl-25	
08[a]	non-forested								

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[a] Based on less than 10 plots.

ESSFwm

Species Selection Guidelines and Stocking Standards

Site series	Species		M.S.S.	Regen delay	Free growing assessment		Target stocking	Leader growth	
	Preferred	Acceptable			Early	Late		Pref.	Acc.
02[a]	Pl,Se	Bl[b]	700	7	15	20	1200	Pl-25	15
03[a]	Se,Pl,Bl[b]		700	4	12	20	1200	15, Pl-25	
01[a]	Se,Pl,Bl		700	4	12	20	1200	15, Pl-25	
04[a]	Se,Pl,Bl		700	4	12	20	1200	15, Pl-25	

---

[a] Based on less than 10 plots.

[b] Fd, Lw, Pw show good growth below 1700 m but occur rarely; correct provenance is essential.

ICHwk1

Species Selection Guidelines and Stocking Standards

Site series	Species		M.S.S.	Regen delay	Free growing assessment		Target stocking	Leader growth	
	Preferred	Acceptable			Early	Late		Pref.	Acc.
02[a]	non-forested								
04	Fd	Sxw,Pw[b],Hw,Cw	700	7	12	15(20)[c]	1200	Fd-25, Sxw-15	15, Pw-20
01	Sxw,Fd[d]	Pw[b],Cw,Bl,Hw	700	4	9	15(20)[c]	1200	Fd-25, Sxw-15	15, Pw-20
05	Sxw,Fd	Hw,Bl,Pw[b],Cw	700	4	9	15(20)[c]	1200	Fd-25, Sxw-15	15, Pw-20
06[a]	Cw,Sxw,Fd	Hw	500	4	9	15	1000	Fd-25, Cw-20, Sxw-15	15
07[a]	Sxw,Cw	Hw,Fd	500	4	9	15	1000	Cw-20, Sxw-15	15
08[a]	Sxw	Bl,Hw,Cw	500	4	9	15	1000	15	15
09[a]	non-forested								

---

[a] Based on less than 10 plots.

[b] Pw accepted only if no other preferred or acceptable species on the growing spot and only if no indication of white pine blister rust. Maximum 20 percent stocking per plot for natural regen and 50 percent for "rust-resistant" planted stock.

[c] Extended window for pathological pruning of Pw.

[d] Fd not sampled on this site series but should do well.

ICHvk1

Species Selection Guidelines and Stocking Standards

Site series	Species		M.S.S.	Regen delay	Free growing assessment		Target stocking	Leader growth	
	Preferred	Acceptable			Early	Late		Pref.	Acc.
03[a]	Fd	Pw[b],Cw,Bl,Hw,Sxw	500	7	12	15(20)[d]	1000	Fd-25	15 Pw-20
04	Fd[c],Sxw	Pw[b],Cw,Hw,Bl	700	4	9	15(20)[d]	1200	Fd-25 Sxw-15	15 Pw-20
01	Fd,Sxw	Pw[b],Bl,Cw,Hw	700	4	9	15(20)[d]	1200	Fd-25 Sxw-15	15 Pw-20
05[a]	Sxw,Fd,Cw	Hw	500	4	9	15	1000	Fd-25 Cw-20 Sxw-15	15
06[a]	Sxw	Bl,Hw,Cw	500	4	9	15	1000	15	15

---

[a] Based on less than 10 plots.

[b] Pw accepted only if no other preferred or acceptable species on the growing spot and only if no indication of white pine blister rust. Maximum 20 percent stocking per plot for natural regen and 50 percent for "rust-resistant" planted stock.

[c] Fd not sampled on this site series but should do well.

[d] Extended window for pathological pruning of Pw.

ESSFvc

Species Selection Guidelines and Stocking Standards

Site series	Species		M.S.S.	Regen delay	Free growing assessment		Target stocking	Leader growth	
	Preferred	Acceptable			Early	Late		Pref.	Acc.
02[a]	Se,Bl	Hm	500	7	15	20	1000	15	15
03	Se,Bl	Hm	500	7	15	20	1000	15	15
01	Se,Bl		700	4	12	20	1200	15	
04	Se,Bl		700	4	12	20	1200	15	
05[a]	Se,Bl		500	4	12	20	1000	15	
06[a]	non-forested								

---

[a] Based on data from less than ten plots.

APPENDIX 2.

Explanation of mapping changes and correlation table of old and new classification units

TABLE A2.1. Mapping and subzone/variant code changes

Old[a] code	New code and mapping changes
ESSFa	ESSFdk
ESSFb	ESSFvc, except for: south of Highway 1 now ESSFwc1 and wc4; north of Nagle Creek and Mica Mountain now ESSFwc2
ESSFc	ESSFwc4, except for: elevation band between 1450 and 1650 m now ESSFwc1; Big White area and Midway Range of Monashee Mountains, south of Mount Arthurs now ESSFdc1; Purcells and Rockies now ESSFwm
ESSFe2	ESSFdc1
ICHa1	ICHdw, except for north of Kaslo on west side of Kootenay Lake and north of New Denver now ICHmw2
ICHa2	ICHmw2, except for: north of Shelter Bay on both sides of Upper Arrow Lake now ICHmw3; around Golden now ICHmw1; Galena Bay to Trout Lake now ICHwk1
ICHb	ICHwk1, except for: north of Goldstream River to Mica Creek; upper Kirkup, Jordan, Downie, Goldstream, Tangiers, and Woolsey drainages now ICHvk1
ICHc	ICHmk1, except for: Okanagan Highlands, Boundary Creek and east side of Christian Valley now MSdm1; Hawkins Creek area now MSdk; east side of Christina Lake now ICHdw
ICHd	ICHxw, except for Deer Park area now IDF undifferentiated
IDFf	IDFdm1, except for narrow band between PPdh1 now IDFxh1
IDFg1	IDF undifferentiated
IDFg2	PPdh2
IDFg3	IDFdm2
MSa	MSdk
MSb2	MSdm1, except for area in Okanagan Highlands formerly ICHc
PPBGc	PPdh1

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[a] Utzig *et al.* (1986) classification.

TABLE A2.2. Correlation of old ecosystem associations to present site series

Subzone/ Variant	Ecosystem Association/Site Series						
ESSFa[a]	02	03	04	01	05	06	07
ESSFdk	02	04	03	01	05	06	07
ESSFb	02	03	01	04	05	06	07
ESSFvc	02/03 (80/20)[b]	02/03/01 (20/50/30)	01 (100)	01/04/05/06 (10/65/15/10)	04/05/06 (30/50/20)	06 (100)	*[c]
ESSFc	03	04	01	05	06		
ESSFwm	02 (100)[d]	03 (100)	01 (100)	05 (100)	–		
ESSFwc1	02 (100)	02/01 (75/25)	03/01/03 (30/60/10)	03/04 (80/20)	06 (100)		
ESSFwc4	02/03/04 (75/15/10)	03/04/01 (10/10/80)	04/[illegible]/05 (15/80/5)	01/05/06 (30/60/10)	07/08 (40/60)		
ESSFdc1	03/01 (30/70)	–	04 (100)	–	–		
ESSFe2	02	01	03	04	05		
ESSFdc1	02/03/01/05 (10/40/40/10)	03/01/04/05 (15/30/30/25)	04/05/06 (15/70/15)	06/07 (25/75)	07 (100)		
ICHa1	02	03	01	04	05		
ICHdw	02 (100)	01a (100)	01b (100)	03 (100)	04 (100)		
ICHa2	02	03	01	04	05	06	
ICHmw1	–	02/01 (40/60)	01/02/06/03 (70/10/10/10)	01/05 (30/70)	–	*	
ICHmw2	02/03 (70/30)	03/04 (80/20)	01/05 (90/10)	01/05/08 (10/60/30)	06/08 (75/25)	09 (100)	

TABLE A2.2. (Continued)

Subzone/ Variant	**Ecosystem Association/Site Series**								
ICHb	02	03	04	01	05	06			
ICHvk1	03 (100)	03/04 (10/90)	03/04 (50/50)	04/01 (10/90)	05 (100)	06 (100)			
ICHwk1	04 (100)	04/01/05 (50/45/5)	04/01/05 (20/75/5)	01/05/06 (10/85/5)	06/07 (50/50)	08 (100)			
ICHc	02	03	04	01	05	06	07	08	09
MSdm1	02 (100)	03/04 (10/90)	04/01 (60/40)	01 (100)	01/06 (80/20)	06 (100)	06/08 (25/75)	09 (100)	•
ICHmk1	–	03/01 (60/40)	01 (100)	01 (100)	01/05 (40/60)	05/06 (80/20)	05/06 (20/80)	08 (100)	•
IDFf	02	03	01	04	05	06			
IDFdm1	02/04 (25/75)	02/03/04 (70/20/10)	04/01/05 (45/45/10)	05/06 (90/10)	06/07 (50/50)	07 (100)			
IDFg2	02	03	01	04	05				
PPdh2	02 (100)	•	02b/01 (70/30)	01 (100)	03/04 (75/25)				
IDFg3	03	02	01	04	05	06	07		
IDFdm2	03 (100)	02/03/01 (40/40/20)	03/01 (5/95)	04/05 (90/10)	05/07 (60/40)	06 (100)	•		
MSa	02	03	04	05	01	06	07		
MSdk	02	03	04	05	01	06	07		

TABLE A2.2. (Continued)

Subzone/ Variant	Ecosystem Association/Site Series						
MSb2	02	01	03	04	05	06	07
MSdm1	02/03/04 (10/10/30)	04/02/05 (10/60/30)	06 (100)	05 (100)	06/08/07 (70/20/10)	07 (100)	09 (100)
PPBGc	02	03	01	04	05	06	07
PPdh1	02a (100)	•	03/01 (70/30)	04 (100)	05 (100)	06 (100)	08 (100)

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[a] Utzig *et al.* (1986) classification

[b] Number in brackets denotes % of plots; e.g., ESSFb/02 is now:
80% ESSFvc/02
20% ESSFvc/03

[c] • = type not recognized; anomolous data, poor range condition, or rare wetland types.

[d] Where plots from old ecosystem associations are placed in site series for more than one subzone/variant, percentages refer to proportion of site series within each new subzone/variant only. It does not indicate proportion of old ecosystem associations distributed between new subzones/variants.

APPENDIX 3.

Ecosystem description publications and maps for southeastern British Columbia

Publications

Achuff, P.F., W.D. Holland, G.M. Coen, and K. Van Tighem. 1984. Ecological land classification of Kootenay National Park, British Columbia. Vol. 1. Integrated resource description. Alta. Inst. Pedol., Edmonton, Alta. Publ. No. M-84-10.

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Reference Maps[1]

1:500 000

- Regional wildlife habitat maps:
  East Kootenay
  West Kootenay

- Shining Mountains: ecoregional and zonal vegetation units (in preparation). International grizzly bear study in British Columbia, Alberta, and neighbouring states.

1:250 000

- Biophysical resources of the Purcell Mountains (central portion)

1:50 000

- Purcell biophysical project (Purcell Wilderness Conservancy and adjacent areas)
- Biophysical resources of the East Kootenay
- Habitat map of Goat River area
- Habitat for grizzly bears in the Monashees and Selkirks
- Flathead grizzly bear study.
- Soil and terrain manuscript maps: 82 G/1-8, 10-15; 82 J/2-7, 10-14; 82 O/4; 82 M/1-2, 7-10, 15-16.
- Soils and landforms maps: 82 F/1-16; 82 K/1-16; 82 L/1,8,9,16.
- Vegetation manuscript maps: 82 F/1-16; 82 G/1-8, 10-15; 82 J/2-7, 10-14; 82 L/1-16; 82 O/4.

1:20 000

- Pend D'Orielle Valley project
- Sheep Mountain wildlife management area
- Habitat map for Mt. Michael

1:10 000

- Vegetation resources with wildlife interpretations for Lardeau Flats

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[1] Maps available from Ministry of Environment, Kootenay Regional HQ, Nelson, B.C. and Maps BC, Surveys and Resource Mapping Branch, Victoria, B.C.

APPENDIX 4.

Plant identification references

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APPENDIX 5.

Soil moisture regime identification key[1]

This key is to assist the user in identifying soil moisture regime using readily observable environmental features. It should be applied with caution on steep south slopes of drier subzones. In such cases, the soil moisture regime class may be one class drier. The soil moisture regime classes 0-7, shown in the key, correspond to the terms very xeric (0) to subhydric (7)[2].

Category	Definition
Ridge crest	height of land; usually convex slope shape
Upper slope	the generally convex-shaped, upper portion of a slope
Middle slope	the portion of a slope between the upper and lower slopes; the slope shape is usually straight
Lower slope	the area towards the base of a slope; the slope shape is usually concave; it includes toe slopes which are generally level areas located directly below and adjacent to the lower slope
Flat	any level area (excluding toe slopes); the surface shape is generally horizontal with no significant aspect
Alluvium	post-glacial, active floodplain deposits along rivers and streams in valley bottoms; usually a series of low benches and channels
Depression	any area that is concave in all directions; usually at the foot of a slope or in flat topography
Soil depth	depth from the mineral soil surface to a root restricting layer such as bedrock, strongly compacted, or strongly cemented materials (e.g., "hardpan")
Gleyed	soils that have poor drainage may be gleyed or mottled; permanently saturated (gleyed) soils are dull yellowish, blue, or olive in colour; soils that have orange coloured mottles are indicative of a fluctuating water table
Coarse texture	sandy[3] with >35% volume of coarse fragments or loamy[3] with >70% volume of coarse fragments
Fine texture	silty[3] or clayey[3] with <20% coarse fragment volume

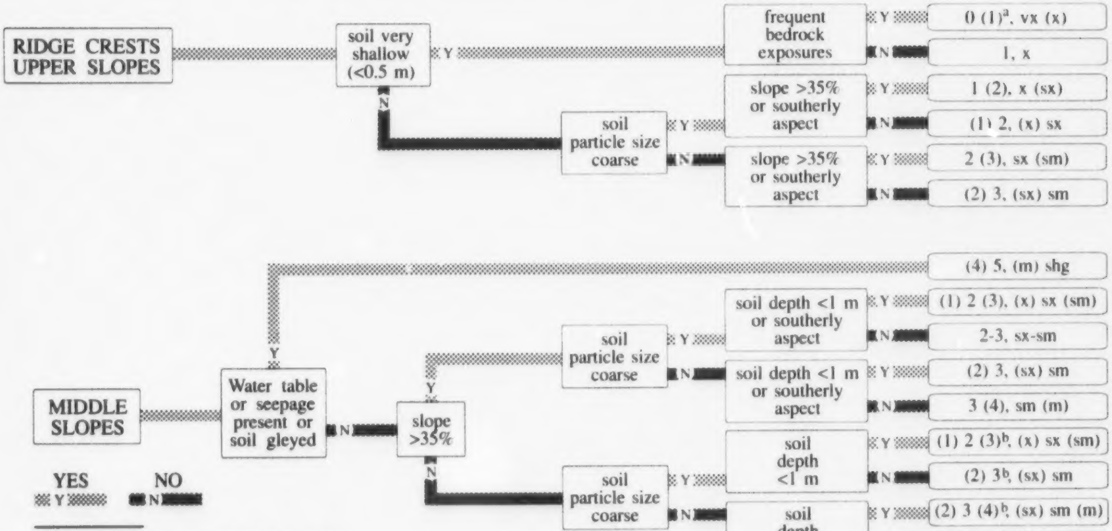
---

[1] Adapted from Lloyd *et al.* (1990) and Green *et al.* (1984).

[2] 0 - very xeric, 1 - xeric, 2 - subxeric, 3 - submesic, 4 - mesic, 5 - subhygric, 6 - hygric, 7 - subhydric.

[3] Sandy - LS, S; loamy - SL, L, SCL; clayey - SiCL, CL, SC, SiC, C; silty - SiL, Si (see Appendix 8 for soil texture determination).

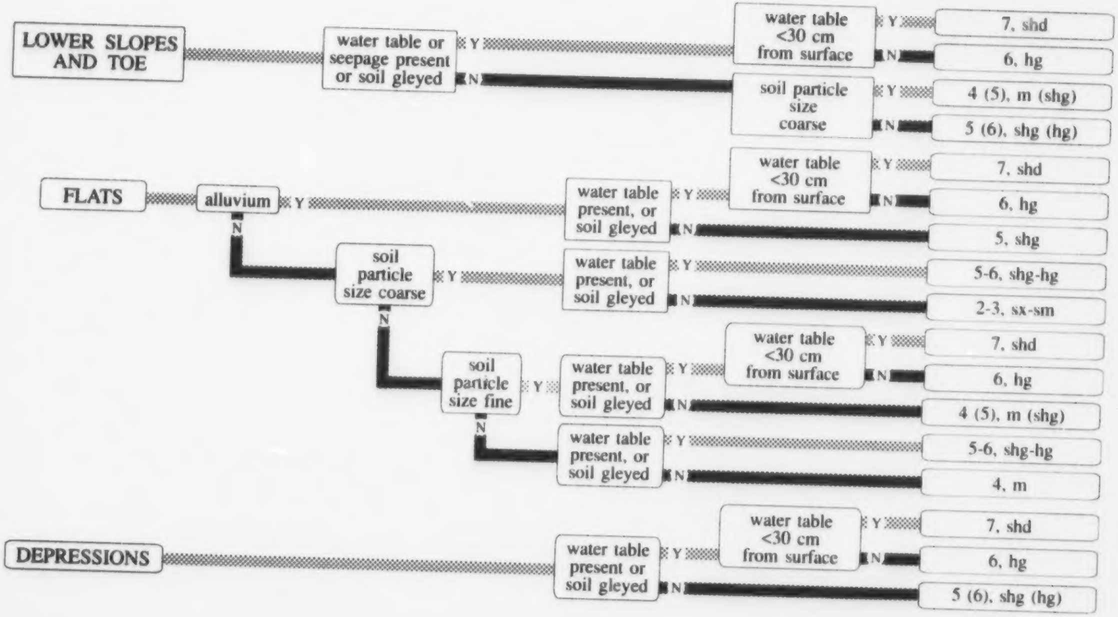
A key to the identification of soil moisture regimes


RIDGE CRESTS UPPER SLOPES
soil very shallow (<0.5 m)
Y
N
frequent bedrock exposures
Y
0 (1)ᵃ, vx (x)
N
1, x
soil particle size coarse
Y
slope >35% or southerly aspect
Y
1 (2), x (sx)
N
(1) 2, (x) sx
N
slope >35% or southerly aspect
Y
2 (3), sx (sm)
N
(2) 3, (sx) sm
MIDDLE SLOPES
Water table or seepage present or soil gleyed
Y
(4) 5, (m) shg
N
slope >35%
Y
soil particle size coarse
Y
soil depth <1 m or southerly aspect
Y
(1) 2 (3), (x) sx (sm)
N
2-3, sx-sm
N
soil depth <1 m or southerly aspect
Y
(2) 3, (sx) sm
N
3 (4), sm (m)
N
soil particle size coarse
Y
soil depth <1 m
Y
(1) 2 (3)ᵇ, (x) sx (sm)
N
(2) 3ᵇ, (sx) sm
N
soil depth <1 m
Y
(2) 3 (4)ᵇ, (sx) sm (m)
N
(3) 4ᵇ, (sm) m
YES
Y
NO
N

---

[a] Values in brackets occur less frequently.

[b] Drier if aspect is south or southwest.


LOWER SLOPES AND TOE
water table or seepage present or soil gleyed
Y
N
water table <30 cm from surface
Y
7, shd
N
6, hg
soil particle size coarse
Y
4 (5), m (shg)
N
5 (6), shg (hg)
FLATS
alluvium
Y
N
water table present, or soil gleyed
Y
water table <30 cm from surface
Y
7, shd
N
6, hg
N
5, shg
soil particle size coarse
Y
water table present, or soil gleyed
Y
5-6, shg-hg
N
2-3, sx-sm
N
soil particle size fine
Y
water table present, or soil gleyed
Y
water table <30 cm from surface
Y
7, shd
N
6, hg
N
4 (5), m (shg)
N
water table present, or soil gleyed
Y
5-6, shg-hg
N
4, m
DEPRESSIONS
water table present or soil gleyed
Y
water table <30 cm from surface
Y
7, shd
N
6, hg
N
5 (6), shg (hg)

APPENDIX 6.

Soil nutrient regime identification table

Soil nutrient regime indicates, on a relative scale, the available nutrient supply for plant growth (Pojar *et al.* 1987). The soil's nutrient regime integrates many environmental and biotic parameters which, in combination, determine the relative amounts of available nutrients. The aim of the assessment is to derive an estimate of the available nutrient supply for a site, which will characterize it relative to all other sites occurring within the biogeoclimatic subzone or variant. The field assessment is a qualitative evaluation of site characteristics. A quantitative assessment is not usually possible because critical nutrient concentrations are unknown for most plant species. Laboratory analysis is also expensive and time consuming.

Common site factors and their relative contribution to soil nutrient regime are shown in the conceptual key on the next page. All of the factors should be evaluated to determine the site nutrient class. Use of the table involves considering the relative levels of all the factors. For example, a site on an upper slope with very coarse soil (sandy texture, 70% C.F.'s) and granitic rock fragments would be classified as very poor for soil nutrients. In contrast, a site on a lower slope with fine textured soil (clayey texture, 10% C.F.'s) and dark coloured upper mineral horizons would be classified as very rich. As many factors as possible should be evaluated because a limiting factor may be compensated for by the effect of other factors. For example, a site with very coarse soil (sandy texture, 80% C.F.'s) on a lower slope could be classified as nutrient-rich *if* continuous seepage were present in the soil profile.

Determination of Soil Nutrient Regime[a]

Characteristic / Soil Nutrient Regime	INCREASING NUTRIENT SUPPLY A Very Poor	B Poor	C Medium	D Rich	E Very Rich
Soil matrix[b] (fine and coarse fraction)	VERY COARSE	COARSE	MEDIUM	FINE	V FINE
Examples	LS, 60% C.F.'s		L, 25% C.F.'s	SiCL, 15% C.F.'s	SiC, 15% C.F.'s
Humus form[c]		MOR		MODER	MULL
Slope Position (related to seepage[d])	UPPER (shedding)		MID (normal)		LOWER (receiving)
Depth to impermeable layer	SHALLOW (<0.5 m)		MEDIUM (1-2 m)		DEEP (>2 m)
Coarse Fragment Type:					
Colour	LIGHT		MEDIUM, MIXED		DARK (OR CALCAREOUS)
Texture	COARSE		MEDIUM		FINE
Hardness	HARD		MEDIUM		SOFT
Examples[e]	granite quartzite sandstone	granodiorite gneiss	diorite schist argillite	gabbro	basalt slate limestone
A Horizon		Ae horizon[f] present		A horizon absent	Ah horizon[g] present
Soil Colour (related to organic matter content)	LIGHT[h]		MEDIUM		DARK

REMEMBER COMPENSATING FACTORS! (Section 3.4.6) **See footnotes next page.**

---

[a] Adapted from Utzig *et al.* (1986) and Green et al. (1984).

[b] Soil Matrix (adapted from Curran *et al.* 1990):

Texture	**Coarse Fragment Content** <30%	 30-70%	 >70%
S, LS, SL	Coarse	Very Coarse	Very Coarse
vfSL, Loam	Medium	Coarse	Very Coarse
SiL, Si	Medium	Medium	Coarse
SiCL, CL, SC, SCL	Fine	Medium	Medium
SiC, C	Very Fine	Fine	Medium

S = sand, sandy
Si = silt, silty
L = loam, loamy
vfSL = very fine sandy loam
C = clay, clayey

[c] See Appendix 8 for humus form identification key.

[d] Seepage = permanent or temporary moving groundwater within the rooting zone during the growing season.

[e] See Appendix 11 for identification key for rock types.

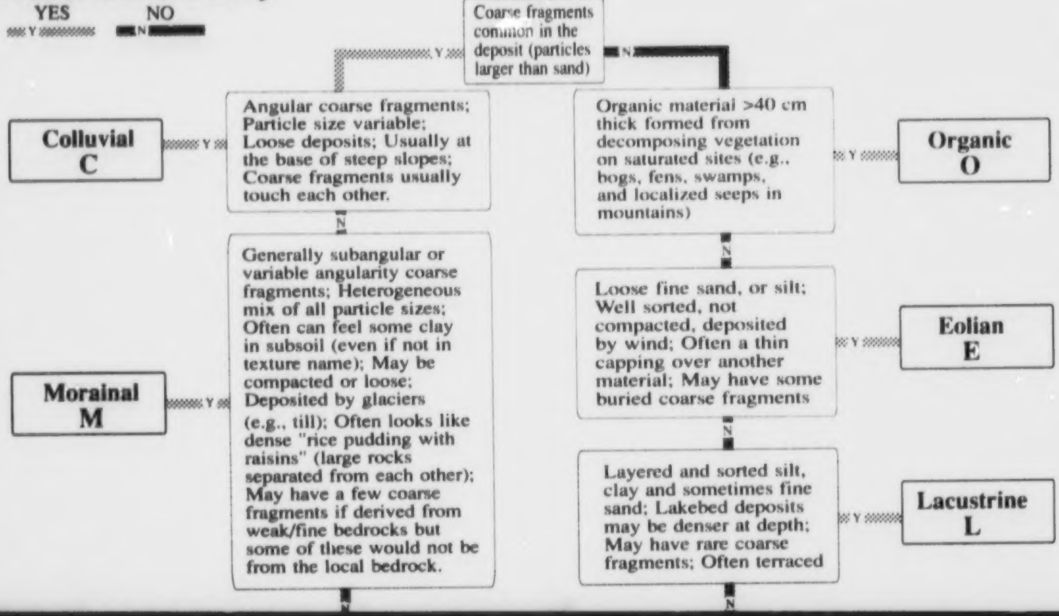
[f] Ae horizon= a leached horizon in the upper soil profile characterized by a grayish colour.

[g] Ah horizon = a dark mineral horizon formed by enrichment of organic matter.

[h] Soil light coloured = soils that have a low organic matter content.

APPENDIX 7.

Parent materials key[1]



Coarse fragments common in the deposit (particles larger than sand)

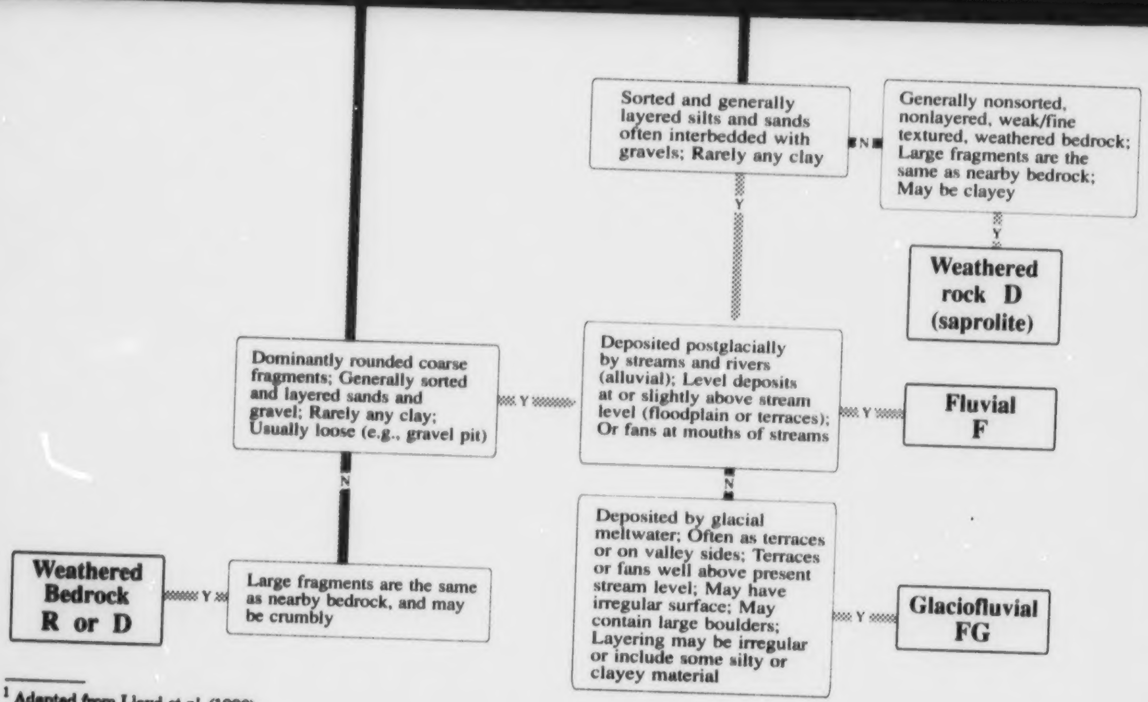
Angular coarse fragments; Particle size variable; Loose deposits; Usually at the base of steep slopes; Coarse fragments usually touch each other.

Generally subangular or variable angularity coarse fragments; Heterogeneous mix of all particle sizes; Often can feel some clay in subsoil (even if not in texture name); May be compacted or loose; Deposited by glaciers (e.g., till); Often looks like dense "rice pudding with raisins" (large rocks separated from each other); May have a few coarse fragments if derived from weak/fine bedrocks but some of these would not be from the local bedrock.

Organic material >40 cm thick formed from decomposing vegetation on saturated sites (e.g., bogs, fens, swamps, and localized seeps in mountains)

Loose fine sand, or silt; Well sorted, not compacted, deposited by wind; Often a thin capping over another material; May have some buried coarse fragments

Layered and sorted silt, clay and sometimes fine sand; Lakebed deposits may be denser at depth; May have rare coarse fragments; Often terraced


Sorted and generally layered silts and sands often interbedded with gravels; Rarely any clay
N
Generally nonsorted, nonlayered, weak/fine textured, weathered bedrock; Large fragments are the same as nearby bedrock; May be clayey
Y
Weathered rock D (saprolite)
Y
Dominantly rounded coarse fragments; Generally sorted and layered sands and gravel; Rarely any clay; Usually loose (e.g., gravel pit)
Y
Deposited postglacially by streams and rivers (alluvial); Level deposits at or slightly above stream level (floodplain or terraces); Or fans at mouths of streams
Y
Fluvial F
N
Deposited by glacial meltwater; Often as terraces or on valley sides; Terraces or fans well above present stream level; May have irregular surface; May contain large boulders; Layering may be irregular or include some silty or clayey material
Y
Glaciofluvial FG
N
Large fragments are the same as nearby bedrock, and may be crumbly
Y
Weathered Bedrock R or D

---

[1] Adapted from Lloyd *et al.* (1990)

APPENDIX 8.

Soil texturing key

Soil Texture is the relative proportion of various "size fractions" of soil.

The **coarse fragment** fraction consists of particles >2 mm in diameter (for non-spherical particles measure second largest dimension). They are divided into three size classes: gravels (2-75mm), cobbles (75-250mm) and stones (>250mm). Coarse fragments are estimated visually as a % of the whole soil (by volume): % stones + % cobbles + % gravels + % fine fraction = 100% (total soil).

The **fine** fraction consists of particles less than 2 mm in diameter. Again, the fine fraction is divided into three size classes: sand, silt, and clay. The *relative proportion of fine fraction* particles (**sand, silt**, and **clay**) are estimated through the use of their unique properties of "feel".

Sand - always felt as individual grains (visible when soil is smeared on finger).

Fine Sand - Dry - similar to silt.
- Wet - not soapy or slippery, stiffer than silt (like grinding compound or fine sand paper).

Silt
- Dry - feels floury
- Wet - slippery or soapy, slightly sticky.

Clay
- Dry - forms hard lumps.
- Moist - plastic (like plasticine).
- Wet - very sticky.

Most soils are a mixture of sand, silt, and clay; so the degree of graininess, soapiness, or stickiness will vary depending upon how much of each particle size is present. As the amount of clay increases, soil particles bind together better, form stronger casts, and can be rolled into thinner, stronger worms. As sand and silt content increase, the soil binding strength decreases and only weak to moderately strong casts and worms can be formed. The various classes of soil texture, defined on the *textural triangle* in the accompanying figure, are named by a combination of the dominant particle sizes; the term **loam** means a relatively even mix of the three.

The field determination of soil texture is subjective and can only be done consistently with training and experience. Most particles >2mm in size must be removed to enable precise assessment of soil texture - a small 2mm screen helps. The field tests (outlined below and used in sequence with the accompanying flowchart) are provided to assist in the field determination of soil texture:

1. **Graininess Test:** Rub the soil between your fingers. If sand is present, it will feel "grainy". Determine whether sand comprises more or less than 50% of the sample. Sandy soils often sound gritty when worked in the hand (do you hear the beach?).

2. **Moist Cast Test:** Compress some moist (not wet) soil by clenching it in your hand. If the soil holds together (i.e., forms a "cast"), then test the durability of the cast by tossing it from hand to hand. The more durable it is (e.g., like plasticine) the more clay is present.

3. **Stickiness Test:** Wet the soil thoroughly and compress between thumb and forefinger. Degree of stickiness is determined by noting how strongly the soil adheres to the thumb and forefinger upon the release of pressure, and by how much it stretches. Stickiness increases with clay content.

4. **Taste Test:** Work a small amount of soil between your front teeth. Silt particles are distinguished as fine "grittiness" (e.g., like driving on a dusty road), unlike sand which is distinguished as individual grains (i.e., graininess). Clay has absolutely no grittiness.

5. **Soapiness Test:** Slide thumb and forefinger over wet soil. Degree of soapiness is determined by how soapy/slippery it feels and how much resistance to slip there is (i.e., from clay and sand particles).

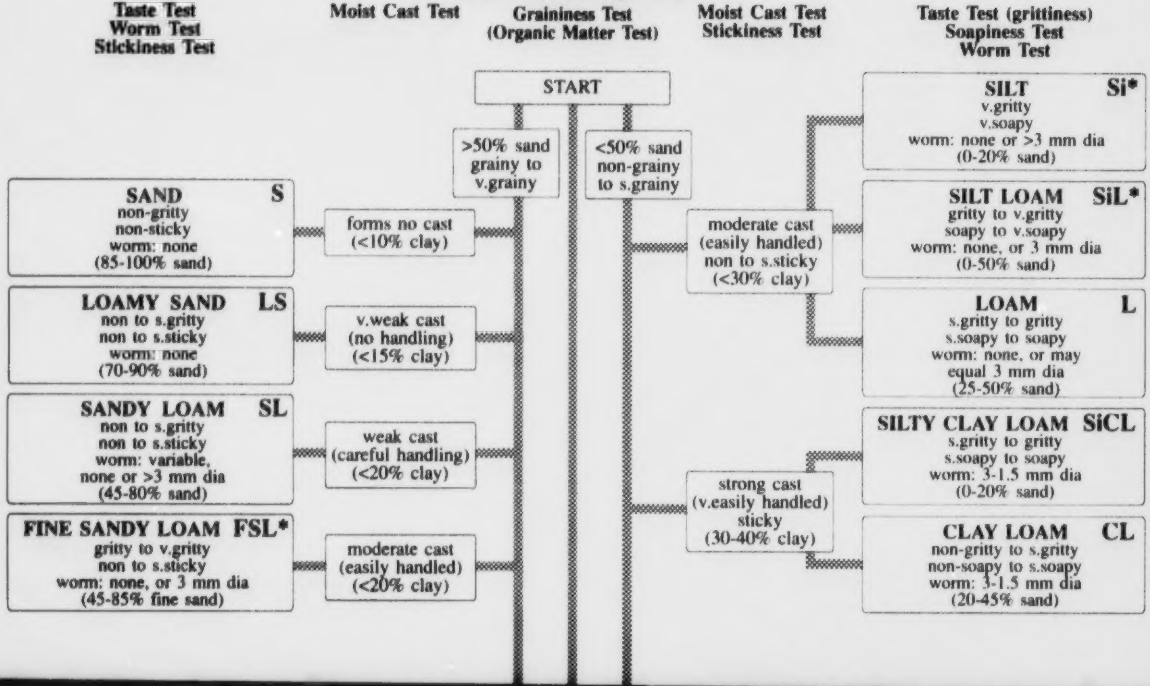
6. **Worm Test:** Roll some moist soil on your palm with your finger to form the longest, thinnest worm possible. The more clay there is in the soil, the longer, thinner, and more durable the worm will be. Try with wetter or drier soil to ensure you have the right moisture content (best worm).

Well decomposed **organic matter** (humus) imparts silt-like properties to the soil. It feels floury when dry and slippery or spongy when moist, but *not* sticky and *not* plastic. However, when subjected to the taste test, it feels non-gritty. It is generally very dark when moist or wet, and stains the hands brown or black. Humus-enriched soils often occur on wet sites in association with a heavy moss cover, and on grasslands. Humus is *not* used as a determinant of soil texture; an estimate of the silt content of any humus-enriched mineral soils should be reduced accordingly.

"Organic" soil samples are those that contain more than 30% organic matter. Soil texture is *not* determined on organic samples. Most organic soils and deep organic horizons are found on wet sites, often in depressions or on flood plains; also in association with dense moss cover (frequently*Sphagnum* spp.).

For more information on soil texturing, see Mitchell *et al* (1991).

Soil Texturing Key


Taste Test
Worm Test
Stickiness Test
Moist Cast Test
Graininess Test
(Organic Matter Test)
Moist Cast Test
Stickiness Test
Taste Test (grittiness)
Soapiness Test
Worm Test
START
>50% sand grainy to v.grainy
<50% sand non-grainy to s.grainy
forms no cast (<10% clay)
v.weak cast (no handling) (<15% clay)
weak cast (careful handling) (<20% clay)
moderate cast (easily handled) (<20% clay)
SAND S
non-gritty
non-sticky
worm: none
(85-100% sand)
LOAMY SAND LS
non to s.gritty
non to s.sticky
worm: none
(70-90% sand)
SANDY LOAM SL
non to s.gritty
non to s.sticky
worm: variable, none or >3 mm dia
(45-80% sand)
FINE SANDY LOAM FSL*
gritty to v.gritty
non to s.sticky
worm: none, or 3 mm dia
(45-85% fine sand)
moderate cast (easily handled) non to s.sticky (<30% clay)
strong cast (v.easily handled) sticky (30-40% clay)
SILT Si*
v.gritty
v.soapy
worm: none or >3 mm dia
(0-20% sand)
SILT LOAM SiL*
gritty to v.gritty
soapy to v.soapy
worm: none, or 3 mm dia
(0-50% sand)
LOAM L
s.gritty to gritty
s.soapy to soapy
worm: none, or may equal 3 mm dia
(25-50% sand)
SILTY CLAY LOAM SiCL
s.gritty to gritty
s.soapy to soapy
worm: 3-1.5 mm dia
(0-20% sand)
CLAY LOAM CL
non-gritty to s.gritty
non-soapy to s.soapy
worm: 3-1.5 mm dia
(20-45% sand)

SANDY CLAY LOAM SCL
non to s.gritty
s.sticky to sticky
worm: 3 mm dia
(45-80% sand)

SANDY CLAY SC
non-gritty
sticky to v.sticky
worm: 3-1.5 mm dia
(45-65% sand)

strong cast
(v.easily handled)
(20-55% clay)

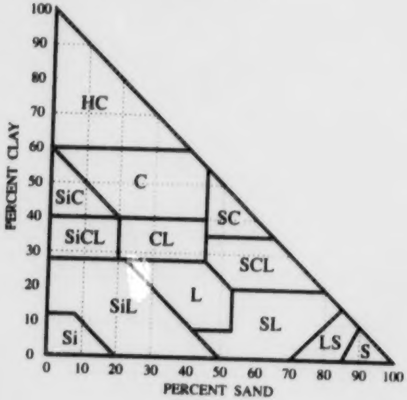
very strong cast
(v.easily handled)
v.sticky
(>40% clay)

SILTY CLAY SiC
s.gritty to gritty
s.soapy to soapy
worm: strong; 1.5 mm dia
(0-20% sand)

CLAY or HEAVY CLAY C or HC
non-gritty to s.gritty
non-soapy to s.soapy
worm: strong; 1.5 mm dia
(0-45% sand)

>30% organic matter

ORGANIC O
(no texture)



* Silt feels slippery or soapy when wet; fine sand feels stiffer, like grinding compound or fine sand paper.

Key to Abbreviations	**Measurement Conversions**
s = slightly	3.0 mm = 1/8"
v = very	1.5 mm = 1/16"
dia = diameter	

Fine Fraction	**(particle diameter)**
SAND ------------- (S)	2 - .05 mm
SILT -------------- (Si)	.05 - .002 mm
CLAY ------------- (C)	<.002 mm
HEAVY CLAY - (HC)	>60 % Clay
LOAM ------------ (L)	mix of Sand, Silt, and Clay

APPENDIX 9.

Humus forms key[1]

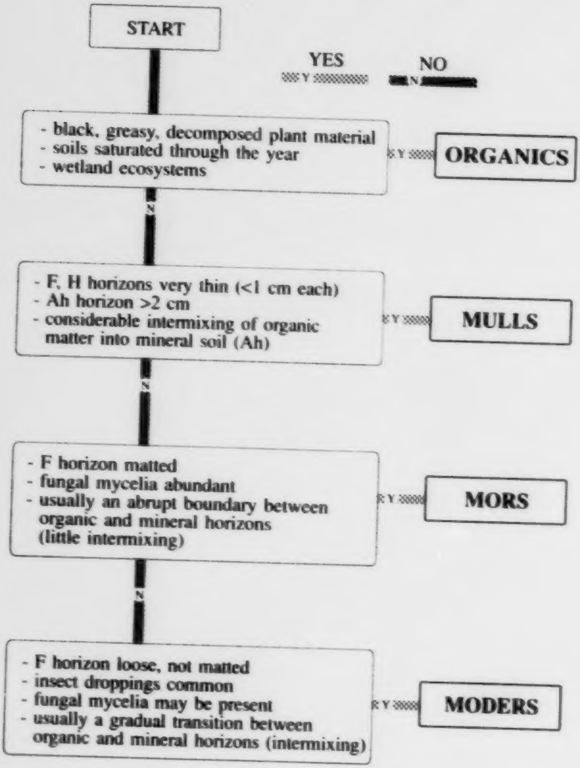
This key assists users in identifying humus forms to the order level, through the use of readily observable forest floor characteristics.

Term	Definition
Ah horizon	a mineral horizon formed at or near the soil surface and enriched with organic matter
L horizon	the litter layer, consisting of relatively fresh residues of foliage, twigs, wood, and dead moss
F horizon	a horizon in which plant residues are partially decomposed; these are discoloured and fragmented but still largely recognizable
H horizon	a horizon dominated by well-decomposed organic material; the original structure is no longer recognizable
Fungal mycelia	a mass of thread-like filaments that constitute the "vegetative" phase of fungal development; many are brown, black, grey, white, red, or yellow; others are transparent

---

[1] **Adapted from Lloyd *et al* .(1990).**

A key for identifying humus forms


START
YES
Y
NO
N
- black, greasy, decomposed plant material
- soils saturated through the year
- wetland ecosystems
Y
ORGANICS
N
- F, H horizons very thin (<1 cm each)
- Ah horizon >2 cm
- considerable intermixing of organic matter into mineral soil (Ah)
Y
MULLS
N
- F horizon matted
- fungal mycelia abundant
- usually an abrupt boundary between organic and mineral horizons (little intermixing)
Y
MORS
N
- F horizon loose, not matted
- insect droppings common
- fungal mycelia may be present
- usually a gradual transition between organic and mineral horizons (intermixing)
Y
MODERS

APPENDIX 10.

Forage and erosion control seeding mixes

The following seed mixes and application rates are presented as examples. Considerations such as price and availability of seed, as well as site and climatic factors, should influence both species composition and application rate of the seed mixes. Consult with district or regional range officer for further information.

These mixes are presented on a weight basis. Ratios and seeding rates have been calculated to ensure the desired live pure seeds per square metre is achieved. Seeding time should be early spring, just after snow is gone or (if this is not possible) late fall, before permanent snowfall. Seeding should be done as soon as possible after site preparation. All legumes should be inoculated.

1. Forage seeding mixes

1.1 Dry forest interim grazing mix

Orchardgrass[1]	70%
Slender wheatgrass	19%
Alsike clover	6%
Rangelander/Rambler alfalfa	5%

Seeding rate: 4-10 kg/ha

Areas of applicability: PPdh1 01,04,05,06; PPdh2 01,03,04; all of IDF except as noted for 1.2.

1.2 Wet forest interim grazing mix

Alsike clover	8%
Orchardgrass	67%
Perennial ryegrass	25%

Seeding rate: 2-4 kg/ha

Areas of applicability: IDFdm1 05,06; IDFdm2 06,07; all of MS, ESSF and ICH. If overtopping of tree seedlings by forage is a concern, substitute white Dutch for Alsike clover at same percentage.

2. Erosion control mixes

Application rates are based on hydraulic seeding. Where seeding method places seed below soil surface, seeding rates can be reduced by 25%. In many cases, fertilizer should be added. Application rates must be adjusted according to erosion potential. Consider the addition of cover crops (ryegrasses, grains) on very high erosion potential sites (cut and fill slopes).

---

[1] An alternative mix for dry, open sites would include 35% meadow brome and 35% orchardgrass.

2.1 Dry range erosion control mix

Rambler alfalfa	20%
Intermediate wheatgrass	20%
Smooth bromegrass	15%
Crested wheatgrass	30%
Slender wheatgrass	15%

Seeding rate: 20 kg/ha

Areas of applicability: PPdh1 02,03; PPdh2 02a,02b.

2.2 Dry forest erosion control mix

Alsike clover	15%
Creeping red fescue	20%
Timothy	10%
Intermediate wheatgrass	30%
Orchardgrass	25%

Seeding rate: 30 kg/ha

Areas of applicability: PPdh1 01,04,05,06; PPdh2 01,03,04; all of IDF except as in 2.3.

2.3 Wet forest erosion control mix

White Dutch clover	25%
Alsike clover	25%
Creeping red fescue	25%
Kentucky bluegrass	5%
Annual or perennial ryegrass	20%

Seeding rate: 30-35 kg/ha

Area of applicability: all sites in ICH, MSdk 02,03,04; MSdm1 02,03,04,01; IDFdm1 05,06; IDFdm2 06,07; not recommended on cut and fill slopes where erosion hazard is high.

2.4 Spruce fir erosion control mix

White Dutch clover	20%
Alsike clover	20%
Creeping red fescue	25%
Mountain brome	10%
Annual ryegrass	15%
Timothy	10%

Seeding rate: 30-35 kg/ha

Area of applicability: all sites in ESSF; MSdk 01,05,06; MSdm1 05,06,08; not recommended on cut and fill slopes where erosion hazard is high.

If the spread of knapweed is of concern, orchardgrass should be added.

2.5 Dry sod-forming mix

Rambler alfalfa	20%
Crested wheatgrass	30%
Redtop	5%
Canada bluegrass	10%
Hard fescue	15%
Slender wheatgrass	20%

Seeding rate: 30 kg/ha

Areas of applicability: all sites in PP; designated for road rights-of-way, cut and fill slopes and high traffic areas.

2.6 Moist sod-forming mix

White Dutch or Alsike clover	20%
Redtop	10%
Creeping red fescue	40%
Kentucky bluegrass	15%
Perennial ryegrass	15%

Seeding rate: 30 kg/ha

Areas of applicability: all slopes in IDF, MS, ICH and ESSF; designed for road rights-of-way, cut and fill slopes, and high traffic areas.

3. Special use mixes

3.1 Lodgepole pine spacing mix

Alsike clover	15%
Redtop	10%
Creeping red fescue	25%
Kentucky bluegrass	25%
Smooth bromegrass	25%

Perennial ryegrass can be included to give early establishment.

Seeding rate: 30 kg/ha

3.2 Silvi-mix (spring seeding only)

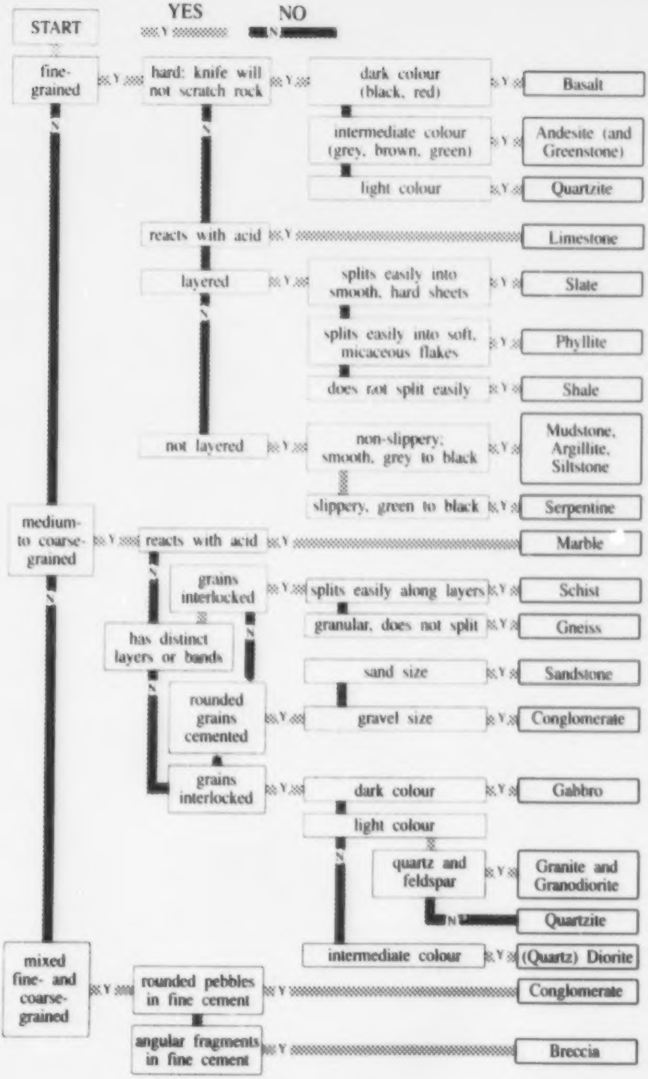
Sweet clover	75%
Orchardgrass	25%

Seeding rate: 2 kg/ha

Area of applicability: used for breaking subsurface compaction on landings.

APPENDIX 11.

Key to the identification of common rocks in the Nelson Forest Region


START
YES
Y
NO
N
fine-grained
hard: knife will not scratch rock
dark colour (black, red)
Basalt
intermediate colour (grey, brown, green)
Andesite (and Greenstone)
light colour
Quartzite
reacts with acid
Limestone
layered
splits easily into smooth, hard sheets
Slate
splits easily into soft, micaceous flakes
Phyllite
does not split easily
Shale
not layered
non-slippery; smooth, grey to black
Mudstone, Argillite, Siltstone
slippery, green to black
Serpentine
medium- to coarse-grained
reacts with acid
Marble
grains interlocked
splits easily along layers
Schist
granular, does not split
Gneiss
has distinct layers or bands
sand size
Sandstone
rounded grains cemented
gravel size
Conglomerate
grains interlocked
dark colour
Gabbro
light colour
quartz and feldspar
Granite and Granodiorite
Quartzite
intermediate colour
(Quartz) Diorite
mixed fine- and coarse-grained
rounded pebbles in fine cement
Conglomerate
angular fragments in fine cement
Breccia

Adapted from Lloyd *et al.* (1990).

APPENDIX 12.

Climate descriptions

The climate descriptions found in the subzone/variant summary pages, (eg. very hot, dry summers), represent a relative comparison amongst subzones within the Nelson Forest Region. These relative climatic classes are based on the normalized long-, and short-term Atmospheric Environmental Service (AES) climate data available (Table 4.2). The number of climate stations within each subzone/variant is indicated in Table 4.2. Climate data are not currently available for nine subzone/variants in the Nelson Forest Region; for these the descriptions are based on local experience and neighbouring subzone/variants.

These data are presented for comparison purposes and characterize the subzone/variants as best as possible. The classes outlined in the summary pages may differ by one class in any given location. The relative scales used follow:

Mean summer temperature (°C)	
very hot	> 12.6
hot	10.1 to 12.5
warm	7.1 to 10.0
cool	< 7.0

Mean winter temperature (°C)	
very mild	> 1.5
mild	0.0 to 1.4
cool	-1.9 to -0.1
cold	-4.0 to -2.0
very cold	< -4.1

Mean summer precipitation (mm)	
very dry	< 200
dry	201 to 230
moist	231 to 300
wet	301 to 400
very wet	> 400

Mean snowfall (mm) (water equivalent)	
very light	< 200
light	201 to 350
moderate	351 to 500
heavy	501 to 800
very heavy	> 801

Average maximum snowpack (cm)	
insignificant	< 30
very shallow	< 60
shallow	< 100
moderate	< 150
deep	100 to 200
very deep	> 200

Snow cover duration (mos.)	
very short	≤ 3
short	≤ 4
moderate	≤ 6
long	≤ 8
very long	≤ 9

Dry soil conditions[1]	**(approx. mos.)**
long	2 to 3
short	< 1
insignificant	< 0.5

Frozen soil conditions	**(approx. cm)**
not expected[2]	0
shallow	15

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[1] On the subzone/variant summary pages, the ranges given reflect the expected conditions on xeric to subhygric moisture regimes.

[2] The only usual exception is very shallow freezing during brief periods before snowfall and after snowmelt.

APPENDIX 13.

Common plants and tree codes of the Nelson Forest Region

COMMON NAME	LATIN NAME
Trees	
aspen, trembling (At[1])	*Populus tremuloides*
birch, paper (Ep)	*Betula papyrifera*
cascara	*Rhamnus purshiana*
cottonwood, black (Act)	*Populus balsamifera* ssp. *trichocarpa*
Douglas-fir (Fd)	*Pseudotsuga menziesii*
fir, grand (Bg)	*Abies grandis*
fir, subalpine (Bl)	*Abies lasiocarpa*
hemlock, mountain (Hm)	*Tsuga mertensiana*
hemlock, western (Hw)	*Tsuga heterophylla*
larch, alpine (La)	*Larix lyallii*
larch, western (Lw)	*Larix occidentalis*
maple, Douglas	*Acer glabrum*
pine, limber (Pf)	*Pinus flexilis*
pine, lodgepole (Pl)	*Pinus contorta*
pine, ponderosa/yellow (Py)	*Pinus ponderosa*
pine, western white (Pw)	*Pinus monticola*
pine, whitebark (Pa)	*Pinus albicaulis*
redcedar, western (Cw)	*Thuja plicata*
spruce, Engelmann (Se)	*Picea engelmannii*
spruce, hybrid white (Sxw)	*Picea glauca x engelmannii*
yew, western	*Taxus brevifolia*
Shrubs	
alder, mountain	*Alnus tenuifolia*
alder, Sitka	*Alnus crispa* ssp. *sinuata*
antelope-brush	*Purshia tridentata*
azalea, false	*Menziesia ferruginea*
birch, scrub	*Betula glandulosa*
blueberry, oval-leaved	*Vaccinium ovalifolium*
ceanothus, redstem	*Ceanothus sanguineus*
cherry, bitter	*Prunus emarginata*
cherry, choke	*Prunus virginiana*
cinquefoil, shrubby	*Potentilla fruticosa*
currant, northern black	*Ribes hudsonianum*
currant, squaw	*Ribes cereum*
currant, sticky	*Ribes viscosissimum*

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[1] Tree species codes follow British Columbia Ministry of Forests, Inventory Branch standards.

COMMON NAME	LATIN NAME
devil's club	*Oplopanax horridus*
dogwood, red-osier	*Cornus stolonifera*
elderberry, blue	*Sambucus cerulea*
elderberry, red	*Sambucus racemosa*
falsebox	*Paxistima myrsinites*
gooseberry, black	*Ribes lacustre*
gooseberry, white-stemmed	*Ribes inerme*
hazelnut, beaked	*Corylus cornuta*
highbush-cranberry	*Viburnum edule*
honeysuckle, Utah	*Lonicera utahensis*
honeysuckle, western trumpet	*Lonicera ciliosa*
huckleberry, black	*Vaccinium membranaceum*
juniper, common	*Juniperus communis*
juniper, Rocky Mountain	*Juniperus scopulorum*
Labrador tea	*Ledum groenlandicum*
mountain-ash, Sitka	*Sorbus sitchensis*
mountain-ash, western	*Sorbus scopulina*
ninebark, mallow	*Physocarpus malvaceus*
ocean-spray	*Holodiscus discolor*
Oregon-grape, tall	*Mahonia aquifolium*
penstemon, shrubby	*Penstemon fruticosus*
rabbit-brush	*Chrysothamnus nauseosus*
raspberry, red	*Rubus idaeus*
rhododendron, white-flowered	*Rhododendron albiflorum*
rose, baldhip	*Rosa gymnocarpa*
rose, Nootka	*Rosa nutkana*
rose, prairie	*Rosa woodsii*
rose, prickly	*Rosa acicularis*
sage, pasture	*Artemisia frigida*
snowberry, common	*Symphoricarpos albus*
snowbrush	*Ceanothus velutinus*
soopolallie	*Shepherdia canadensis*
spirea, birch-leaved	*Spiraea betulifolia*
sumac	*Rhus glabra*
thimbleberry	*Rubus parviflorus*
trapper's tea	*Ledum glandulosum*
wolf-willow	*Elaeagnus commutata*
Herbs	
alumroot, round-leaved	*Heuchera cylindrica*
American brooklime	*Veronica americana*
arnica, heart-leaved	*Arnica cordifolia*
arnica, mountain	*Arnica latifolia*
aster, fringed	*Aster ciliolatus*
aster, leafy	*Aster foliaceus*
aster, showy	*Aster conspicuus*
avens, large-leaved	*Geum macrophyllum*
balsamroot, arrow-leaved	*Balsamorhiza sagittata*

COMMON NAME	LATIN NAME
baneberry	*Actaea rubra*
barley, foxtail	*Hordeum jubatum*
bear-grass	*Xerophyllum tenax*
bedstraw northern	*Galium boreale*
bedstraw, sweet-scented	*Galium triflorum*
bilberry, low	*Vaccinium myrtillus*
bitterroot	*Lewisia rediviva*
bladderpod, Columbia	*Lesquerella douglasii*
bluebells, tall	*Mertensia paniculata*
blueberry, dwarf	*Vaccinium caespitosum*
blue-eyed Mary, small-flowered	*Collinsia parviflora*
bluegrass, Kentucky	*Poa pratensis*
bluejoint	*Calamagrostis canadensis*
bog-laurel	*Kalmia microphylla ssp. occidentalis*
bog-orchid, white	*Platanthera dilatata*
bracken	*Pteridium aquilinum*
bramble, five-leaved	*Rubus pedatus*
brome, Columbia	*Bromus vulgaris*
brome, fringed	*Bromus ciliatus*
brown-eyed Susan	*Gaillardia aristata*
buckwheat, parsnip-flowered	*Eriogonum heracleoides*
bugbane, false	*Trautvetteria caroliniensis*
bunchberry	*Cornus canadensis*
buttercup, meadow	*Ranunculus acris*
buttercup, subalpine	*Ranunculus eschscholtzii*
butterweed, streambank	*Senecio pseudaureus*
campion, Douglas'	*Silene douglasii*
cheatgrass	*Bromus tectorum*
chickweed, field	*Cerastium arvense*
cinquefoil, graceful	*Potentilla gracilis*
cinquefoil, marsh	*Potentilla palustris*
clematis, blue	*Clematis occidentalis*
clover, white	*Trifolium repens*
clubmoss, running	*Lycopodium clavatum*
clubmoss, stiff	*Lycopodium annotinum*
collomia, narrow-leaved	*Collomia linearis*
coltsfoot, arrow-leaved	*Petasites sagittatus*
coltsfoot, palmate	*Petasites frigidus*
columbine, red	*Aquilegia formosa*
columbine, yellow	*Aquilegia flavescens*
coralroot, spotted	*Corallorhiza maculata ssp. maculata*
coralroot, striped	*Corallorhiza striata*
cow-parsnip	*Heracleum lanatum*
crowberry	*Empetrum nigrum*
daisy, oxeye	*Leucanthemum vulgare*
daisy, subalpine	*Erigeron peregrinus*
dandelion, common	*Taraxacum officinale*

COMMON NAME	LATIN NAME
death-camas, meadow	*Zigadenus venenosus*
death-camas, mountain	*Zigadenus elegans*
desert-parsley, fern-leaved	*Lomatium dissectum*
desert-parsley, narrow-leaved	*Lomatium triternatum*
dogbane, spreading	*Apocynum androsaemifolium*
fairybells, Hooker's	*Disporum hookeri*
fairybells, rough-fruited	*Disporum trachycarpum*
fairyslipper	*Calypso bulbosa*
false Solomon's-seal	*Smilacina racemosa*
false Solomon's-seal, star-flowered	*Smilacina stellata*
fern, beech	*Phegopteris connectilis*
fern, deer	*Blechnum spicant*
fern, fragile	*Cystopteris fragilis*
fern, lady	*Athyrium filix-femina*
fern, maidenhair	*Adiantum pedatum*
fern, mountain holly	*Polystichum lonchitis*
fern, oak	*Gymnocarpium dryopteris*
fern, parsley	*Cryptogramma crispa*
fern, rattlesnake	*Botrychium virginianum*
fern, spiny wood	*Dryopteris expansa*
fescue, Idaho	*Festuca idahoensis*
fescue, rough	*Festuca scabrella*
fescue, western	*Festuca occidentalis*
fireweed	*Epilobium angustifolium*
fleabane, shaggy	*Erigeron pumilus*
foamflower, one-leaved	*Tiarella trifoliata* var. *unifoliata*
fringecup, tall	*Tellima grandiflora*
geranium, Bicknell's	*Geranium bicknellii*
geranium, dovefoot	*Geranium molle*
gilia, scarlet	*Ipomopsis aggregata*
ginger, wild	*Asarum caudatum*
globeflower	*Trollius laxus*
goatsbeard	*Aruncus dioicus*
golden-aster, hairy	*Heterotheca villosa*
goldenrod, Canada	*Solidago canadensis*
goldenrod, spike-like	*Solidago spathulata*
goosefoot, red	*Chenopodium rubrum*
grass, needle-and-thread	*Stipa comata*
grass-of-Parnassus, fringed	*Parnassia fimbriata*
gromwell, yellow	*Lithospermum incisum*
groundsel, arrow-leaved	*Senecio triangularis*
grouseberry	*Vaccinium scoparium*
hairgrass, mountain	*Vahlodea atropurpurea*
hawksbeard, slender	*Crepis atrabarba*
hawkweed, white-flowered	*Hieracium albiflorum*
hedysarum, yellow	*Hedysarum sulphurescens*
hellebore, Indian	*Veratrum viride*
horsetail, common	*Equisetum arvense*

COMMON NAME	LATIN NAME
horsetail, meadow	*Equisetum pratense*
horsetail, wood	*Equisetum sylvaticum*
horseweed	*Conyza canadensis*
hound's-tongue, common	*Cynoglossum officinale*
Indian-pipe	*Monotropa uniflora*
Indian-wheat	*Plantago patagonica*
junegrass	*Koeleria macrantha*
kinnikinnick	*Arctostaphylos uva-ursi*
knapweed, diffuse	*Centaurea diffusa*
knapweed, spotted	*Centaurea maculosa*
larkspur, Montana	*Delphinium bicolor*
lemonweed	*Lithospermum ruderale*
lily, chocolate	*Fritillaria lanceolata*
lily, glacier	*Erythronium grandiflorum*
lily, threespot mariposa	*Calochortus apiculatus*
locoweed, field	*Oxytropis campestris*
lousewort, bracted	*Pedicularis bracteosa*
lousewort, sickletop	*Pedicularis racemosa*
lovage, Canby's	*Ligusticum canbyi*
lupine, arctic	*Lupinus arcticus*
lupine, silky	*Lupinus sericeus*
marsh-marigold, white	*Caltha leptosepala*
meadowrue, western	*Thalictrum occidentale*
milk-vetch, timber	*Astragalus miser*
miner's-lettuce	*Claytonia perfoliata*
miner's-lettuce, Siberian	*Claytonia sibirica*
mitrewort, Brewer's	*Mitella breweri*
mitrewort, common	*Mitella nuda*
mitrewort, five-stamened	*Mitella pentandra*
mock-orange	*Philadelphus lewisii*
monkey-flower, pink	*Mimulus lewisii*
mountain-avens, white	*Dryas octopetala*
mountain-avens, yellow	*Dryas drummondii*
mountainbells	*Stenanthium occidentale*
mountain-heather, pink	*Phyllodoce empetriformis*
mountain-heather, white	*Cassiope mertensiana*
mountain-heather, yellow	*Phyllodoce glanduliflora*
mullein, great	*Verbascum thapsus*
needlegrass, stiff	*Stipa occidentalis*
nettle, stinging	*Urtica dioica*
nightshade, enchanter's	*Circaea alpina*
onion, nodding	*Allium cernuum*
oniongrass	*Melica bulbosa*
orchardgrass	*Dactylis glomerata*
paintbrush, common red	*Castilleja miniata*
partridgefoot	*Luetkea pectinata*
pathfinder	*Adenocaulon bicolor*
pearly everlasting	*Anaphalis margaritacea*
peavine, creamy	*Lathyrus ochroleucus*

COMMON NAME	LATIN NAME
peavine, purple	*Lathyrus nevadensis*
pennycress, field	*Thlaspi arvense*
penstemon, small-flowered	*Penstemon procerus*
penstemon, yellow	*Penstemon confertus*
phacelia, silverleaf	*Phacelia hastata*
phlox, spreading	*Phlox diffusa*
phlox, tufted	*Phlox caespitosa*
pinedrops	*Pterospora andromedea*
poison-ivy	*Rhus radicans*
prairie crocus	*Anemone patens* ssp. *multifida*
prince's pine	*Chimaphila umbellata*
pussytoes, field	*Antennaria neglecta*
pussytoes, racemose	*Antennaria racemosa*
pussytoes, rosy	*Antennaria microphylla*
pussytoes, umber	*Antennaria umbrinella*
queen's cup	*Clintonia uniflora*
raspberry, trailing	*Rubus pubescens*
rattlesnake-plantain	*Goodyera oblongifolia*
ricegrass, rough-leaved	*Oryzopsis asperifolia*
rockcress, Holboell's	*Arabis holboellii*
ryegrass, perennial	*Lolium perenne*
St. John's-wort, common	*Hypericum perforatum*
salsify, yellow	*Tragopogon dubius*
sandwort, thread-leaved	*Arenaria capillaris*
sarsaparilla, wild	*Aralia nudicaulis*
saxifrage, leatherleaf	*Leptarrhena pyrolifolia*
saxifrage, red-stemmed	*Saxifraga lyallii*
saxifrage, spotted	*Saxifraga bronchialis*
scouring-rush	*Equisetum hyemale*
scouring-rush, dwarf	*Equisetum scirpoides*
selaginella, compact	*Selaginella densa*
shootingstar, few-flowered	*Dodecatheon pulchellum*
single delight	*Moneses uniflora*
skunk cabbage	*Lysichiton americanum*
sour weed	*Rumex acetosella*
spurge, leafy	*Euphorbia esula*
stonecrop, lance-leaved	*Sedum lanceolatum*
stonecrop, worm-leaved	*Sedum stenopetalum*
strawberry, wild	*Fragaria virginiana*
strawberry, wood	*Fragaria vesca*
sweet-cicely, mountain	*Osmorhiza chilensis*
tea-berry, western	*Gaultheria ovatifolia*
thistle, bull	*Cirsium vulgare*
thistle, Canada	*Cirsium arvense*
three-awn, red	*Aristida longiseta*
timothy	*Phleum pratense*
toad-flax, bastard	*Geocaulon lividum*
tumble-mustard, tall	*Sisymbrium altissimum*

COMMON NAME	LATIN NAME
twayblade, heart-leaved	*Listera cordata*
twayblade, northwestern	*Listera caurina*
twinflower	*Linnaea borealis*
twistedstalk, clasping	*Streptopus amplexifolius*
twistedstalk, rosy	*Streptopus roseus*
twistedstalk, small	*Streptopus streptopoides*
valerian, Sitka	*Valeriana sitchensis*
vetch, American	*Vicia americana*
violet, Canada	*Viola canadensis*
violet, early blue	*Viola adunca*
violet, kidney-leaved	*Viola renifolia*
violet, round-leaved	*Viola orbiculata*
violet, stream	*Viola glabella*
water-hemlock, Douglas'	*Cicuta douglasii*
wheatgrass, bluebunch	*Agropyron spicatum*
wildrye, blue	*Elymus glaucus*
wildrye, fuzzy-spiked	*Elymus innovatus*
willowherb, small-flowered	*Epilobium minutum*
wintergreen, green	*Pyrola chlorantha*
wintergreen, one-sided	*Orthilia secunda*
wintergreen, pink	*Pyrola asarifolia*
woodland star, small-flowered	*Lithophragma parviflorum*
wood-reed, nodding	*Cinna latifolia*
woodrush, small-flowered	*Luzula parviflora*
woodrush, smooth	*Luzula hitchcockii*
yarrow	*Achillea millefolium*
yellow bell	*Fritillaria pudica*
Mosses, Lichens, and Liverworts	
cladinas	*Cladina* spp.
feathermoss, red-stemmed	*Pleurozium schreberi*
knight's plume	*Ptilium crista-castrensis*
lichen, common coral	*Sterocaulon paschale*
lichen, dog	*Peltigera canina*
lichen, freckled	*Peltigera aphthosa*
liverwort, common leafy	*Barbilophozia lycopodioides*
liverwort, green-tongue	*Marchantia polymorpha*
moss, curly heron's-bill	*Dicranum fuscescens*
moss, electrified cat's-tail	*Rhytidiadelphus triquetrus*
moss, glow	*Aulacomnium palustre*
moss, grey frayed-cap	*Rhacomitrium canescens*
moss, juniper haircap	*Polytrichum juniperinum*
moss, leafy	*Mnium* spp.
moss, pipecleaner	*Rhytidiopsis robusta*
moss, rock	*Rhacomitrium* spp.
moss, sidewalk	*Tortula ruralis*
moss, step	*Hylocomium splendens*
moss, woodsy ragged	*Brachythecium hylotapetum*
sphagnum	*Sphagnum*

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